MAY • 1947

# TOOL & DIE JOURNAL

DESIGN, MANUFACTURE AND USE OF PRODUCTION TOOLING


## PUTNAM End Mills

MAXIMUM

FREE CUTTING

Putnam End Mill roughing out a slot about one-half inch deep in part made of high chrome steel.

**No matter how tough the material, how deep the bite—you'll find that Putnam Hi-Speed End Mills not only cut faster, but have exceptionally free cutting action*. This is due to proper end mill designing and careful manufacturing in a modern plant which for a number of years has specialized in producing quality tools for milling operations.**

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**—carries complete stocks of Putnam Hi-Speed End Mills for prompt delivery to you. Over 800 different *standard* types and sizes of end mills for all milling operations.**

***From unsolicited reports to our field men by machine operators using Putnam End Mills, as well as by many plant executives responsible for milling production.**

PUTNAM TOOL COMPANY

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WHEN TIME IS PRECIOUS—

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FCC Composite Die Sections are quickly available to your order. Shipment to your specifications can usually be made in five to ten days.

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**STEEL CORPORATION**

*Forging and Casting Division*

Detroit 20, Michigan

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DRILLS · TOOL BITS · SPECIALS

# TOOL & DIE JOURNAL

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Tool & Die Journal is published monthly for those industry key men who constitute, in each plant, the Cycle of Buying Influence —CBI—and who are responsible for the design, manufacture and use of production tooling.

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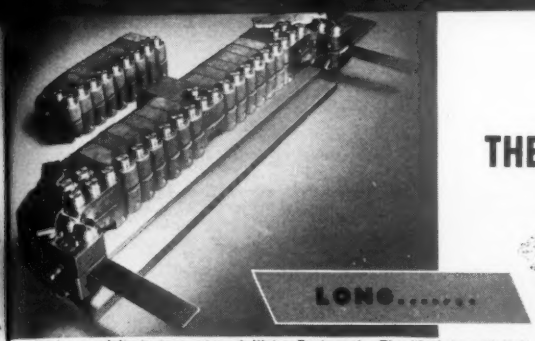
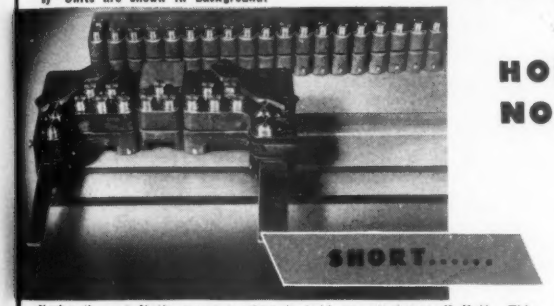
# THE LONG AND SHORT OF IT WITH WALES

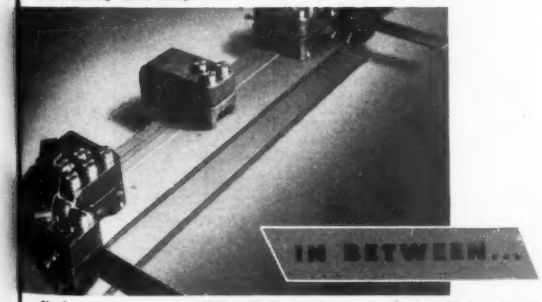
## HOLE PUNCHING AND NOTCHING EQUIPMENT



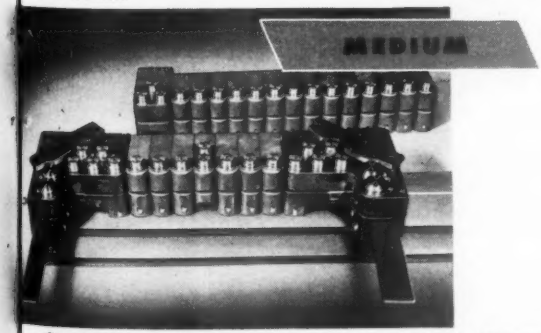

Showing a relatively long setup of Wales Equipment. The "In-between" Units are held in position by the two end Units that are locked to the rail. "Stand-by" Units are shown in background.




Showing the end Units moved together to hold one "in-between" Unit. This is a relatively short setup.




Showing the same group of three Units as above setup for punching at longer center-to-centers.




Showing setup of medium length. The "stand-by" Units in the background may instantly replace the Units in setup or may be added for longer setups. Only the two end Units are locked in position,—the "in-between" Units are simply set on the rail.

●*Only Wales Patented Hole-Punching and Notching Equipment provides these economies of time and money shown at left.*

These setups were used for punching various lengths of shelving with varying hole centers for adjustments of shelf spacings,—at the same time notching the corners. The flexibility of setups required to meet the unlimited number of hole-punching and notching requirements is made possible by two Wales exclusive and patented advantages:—

1. A mounting rail that permits the Wales Units to be placed, replaced, and quickly slid into exact position for each setup.
2. Wales self-contained, independent Hole-Punching and Notching Equipment eliminates any adjustments between punches and dies,—just set Units on rail according to pattern and start operating.

NOTHING CAN BE SIMPLER than sliding the end Notching Units apart, placing the required number of Units in position on the bed rail, then sliding the end Notching Units together against the "In-between" Units. The Notching Units are locked to the rail and hold the other Units in position.

All the Units except the two on the ends may be added or lifted out of the setup without loosening or tightening any screws or clamps. It's tooling simplicity at its ultimate.

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- **PART:** Mold for top of Plastic silverware chest; mild steel, 17⅝" x 13⅝₁₆" x 1¾.
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A heavy duty floor model available with single or dual spindles which turn at 10,000 R P M. with vertical oscillations. Rapid stock removal even with wheels as small as ½" diameter. Uses wheels ½" to 3"

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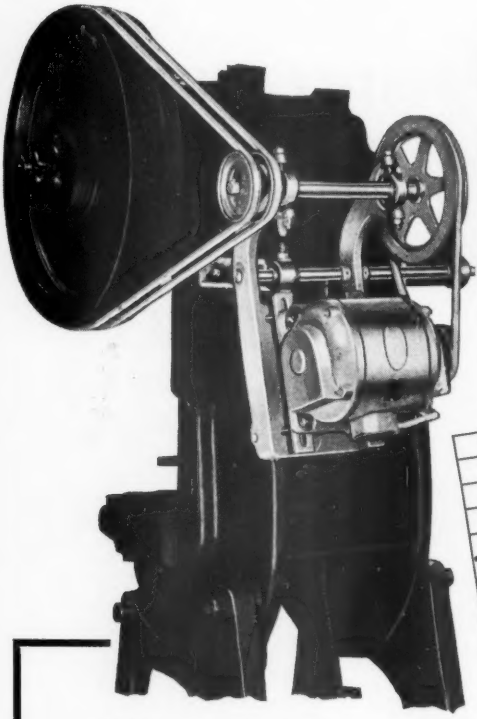

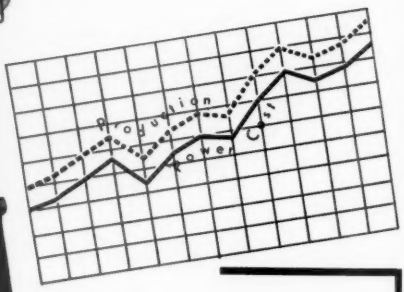


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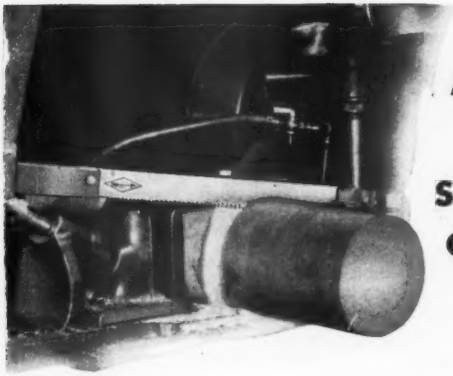

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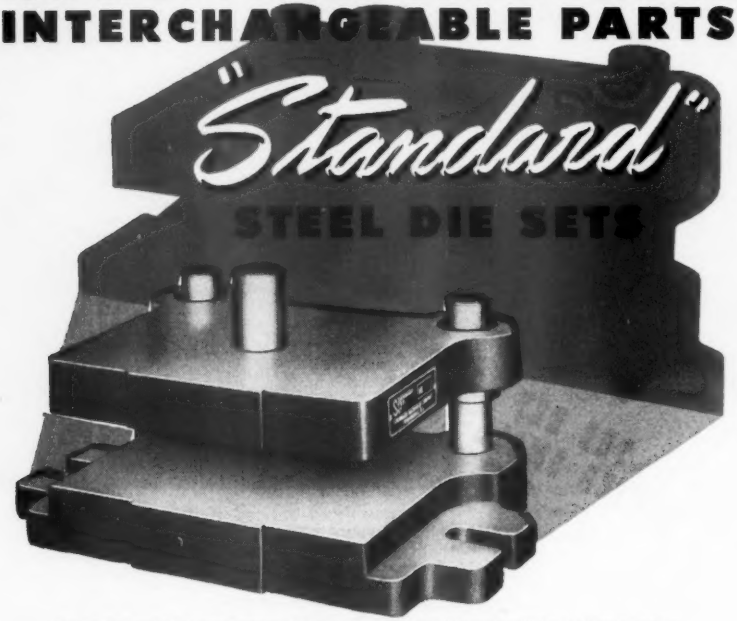


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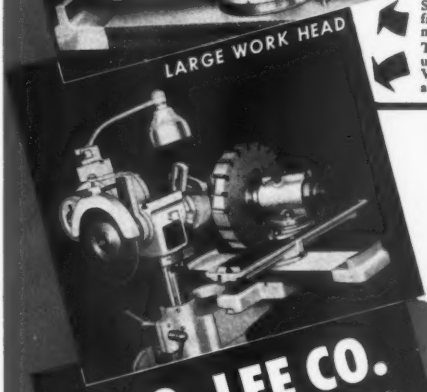
This large sensitive ball-bearing workhead is fully universal and may be used on any make of tool grinder. Various collets, straight sleeves and taper sleeves are available.




The "Knock-Out" Tap Grinding Fixture (above) handles all taps from No. 8 to 2½"—grinds chamfer and flute—reconditions broken taps. You get more pieces per grind and more grinds per tap! With the "Knock-Out" Sensitive Work Head (right) it's easy to grind tools from keyway cutters to 12" mills. Set-ups are simple and fast—grinding is accurate—tools produce more pieces. These, and many other "Knock-Out" cutter grinding fixtures, will help you obtain better sharpened tools that will increase production per man hour.

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Please send us your fully illustrated catalog showing all of the various Knock-Out cutter grinder fixtures.

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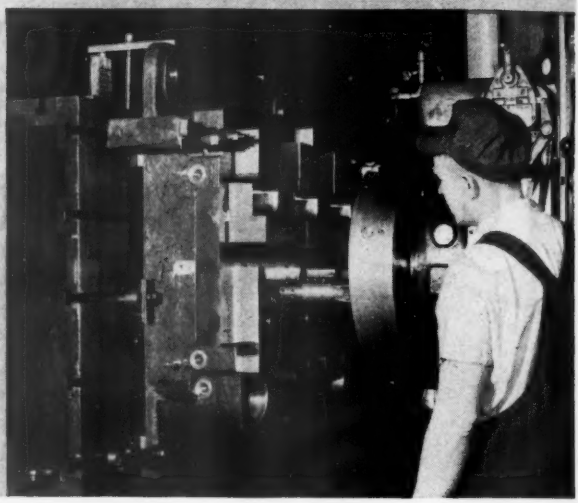
City.....State.....

# *Now* Danly Special Die Sets

## *with any additional machining required*



New equipment installed in the Danly shop permits us to do any machine work on large or complex die sets incidental to the mounting of the dies. Inserts, recesses, additional boring, keyways and other machining can be done to the customer's specifications.

Time is saved by this service as work on dies and on the die set can be done at the same time. It permits the die shop or tool room to devote their equipment and man hours to the making of dies. The problem of the handling of big sets, for which the die shop or tool room are not generally equipped to do economically, is also solved by this service.

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*2100 South 52nd Avenue • Chicago 50, Illinois*

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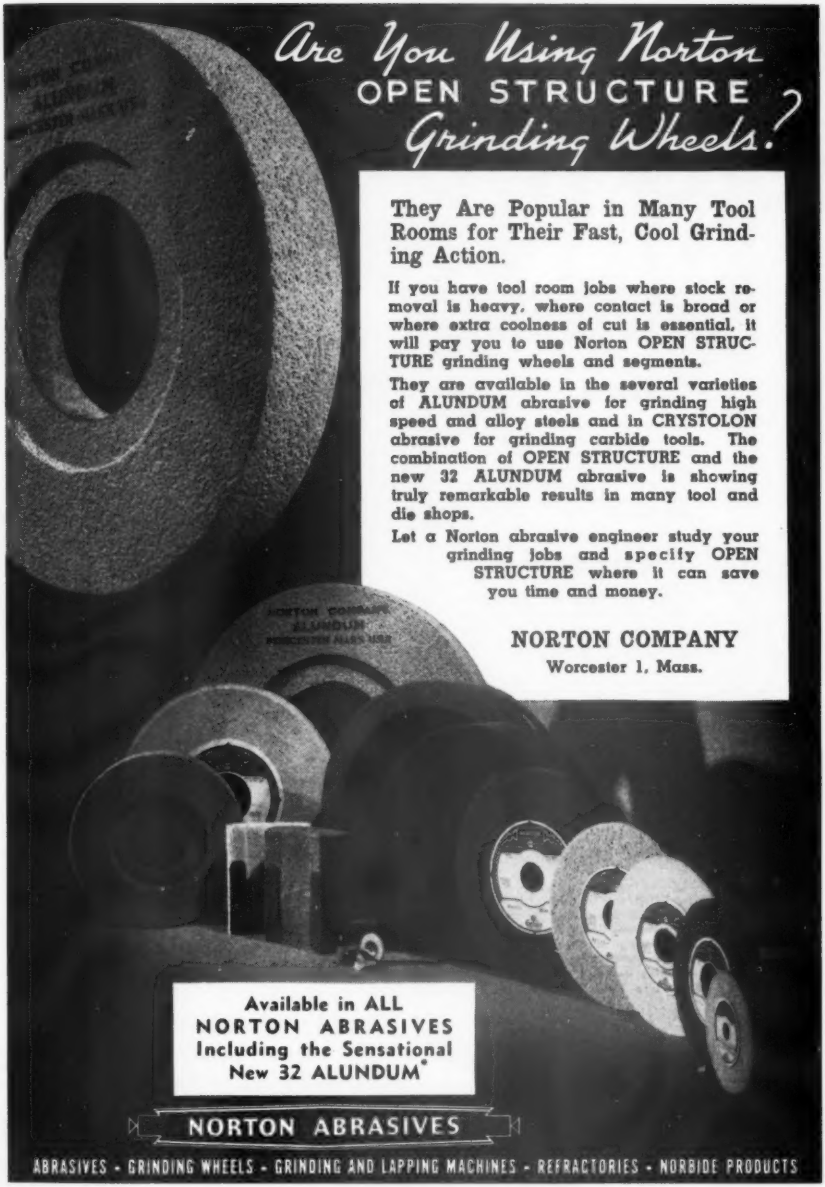
**DANLY *Special* DIE SETS**

***MACHINED TO YOUR SPECIFICATIONS***

# *Are You Using Norton* OPEN STRUCTURE *Grinding Wheels?*



**They Are Popular in Many Tool Rooms for Their Fast, Cool Grinding Action.**

If you have tool room jobs where stock removal is heavy, where contact is broad or where extra coolness of cut is essential, it will pay you to use Norton OPEN STRUCTURE grinding wheels and segments.

They are available in the several varieties of ALUNDUM abrasive for grinding high speed and alloy steels and in CRYSTOLON abrasive for grinding carbide tools. The combination of OPEN STRUCTURE and the new 32 ALUNDUM abrasive is showing truly remarkable results in many tool and die shops.

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Worcester 1, Mass.

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Including the Sensational
New 32 ALUNDUM®

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ABRASIVES - GRINDING WHEELS - GRINDING AND LAPPING MACHINES - REFRACTORIES - NORBIDE PRODUCTS

# SAVE

*The No. 8 showing new Wells Wet Cutting System — an economical accessory available for all No. 8 Wells Saws.*

## ✔time

**If it's *metal cutting*, move the handy Wells saw to the job. It's portable . . . self-contained . . . versatile! Save the time lost in moving material in and out of metal cutting rooms. Get jobs finished quickly, indoors or out. Reduce shop congestion.**

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**Wells Metal Cutting Band Saws are easy to use . . . quick to set up . . . require little supervision. With a Wells, one man can handle many miscellaneous cutting jobs along with other work.**

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**The Wells saw does good work . . . cuts close . . . removes minimum stock. Because operation is simple, any shop man can use it safely and efficiently with minimum waste.**

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**No large capital investment is required for a Wells saw, the machine with many uses. Power operating costs are low. It occupies little floor space and is a profitable utility tool for countless shops. For complete information, send for interesting descriptive literature or see your local Wells distributor.**

Wells SAWS

Wells

## METAL CUTTING BAND SAWS

### *Specifications*

| | |
|---|---|
| CAPACITY: | |
| Rectangular | 8" x 16" |
| Rectangular (special guides) | 5" x 24" |
| Rounds | 8" O. D. |
| MOTOR | ½ H. P., A. C. or D. C. |
| SPEEDS | Selective 60, 90, 130 feet per minute |
| WEIGHT | Approximately 665 pounds |

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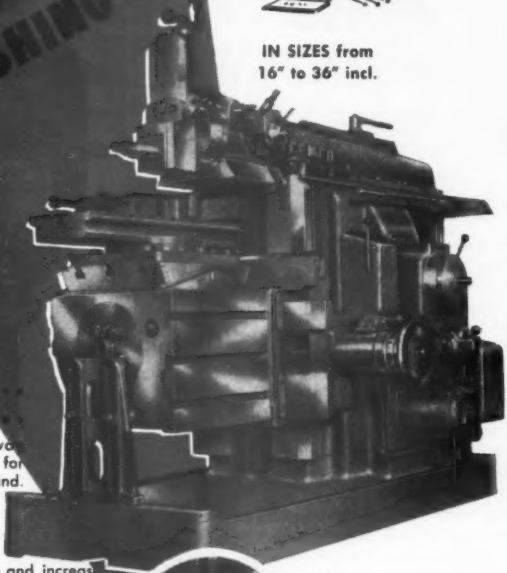

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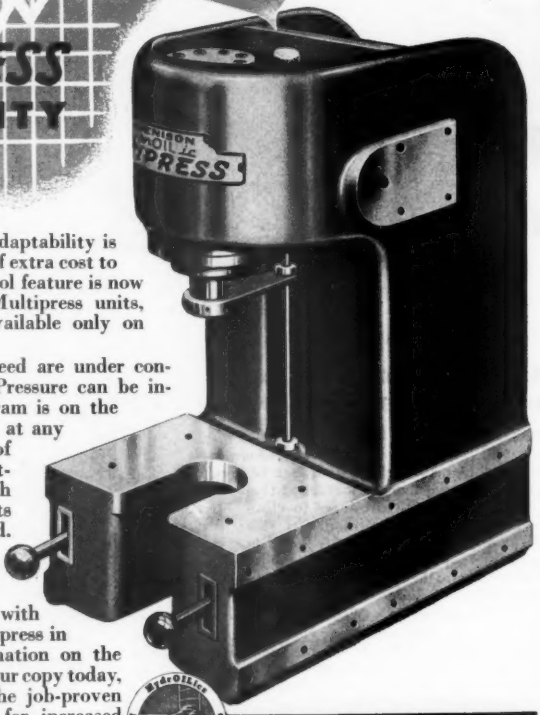

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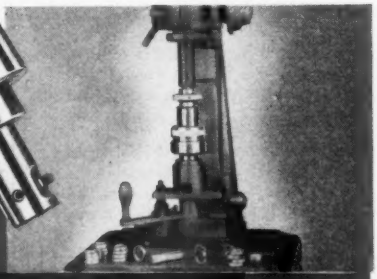

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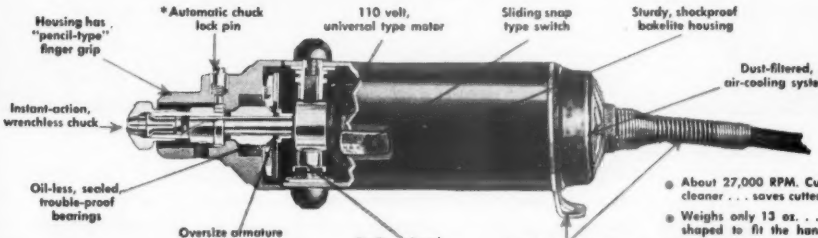
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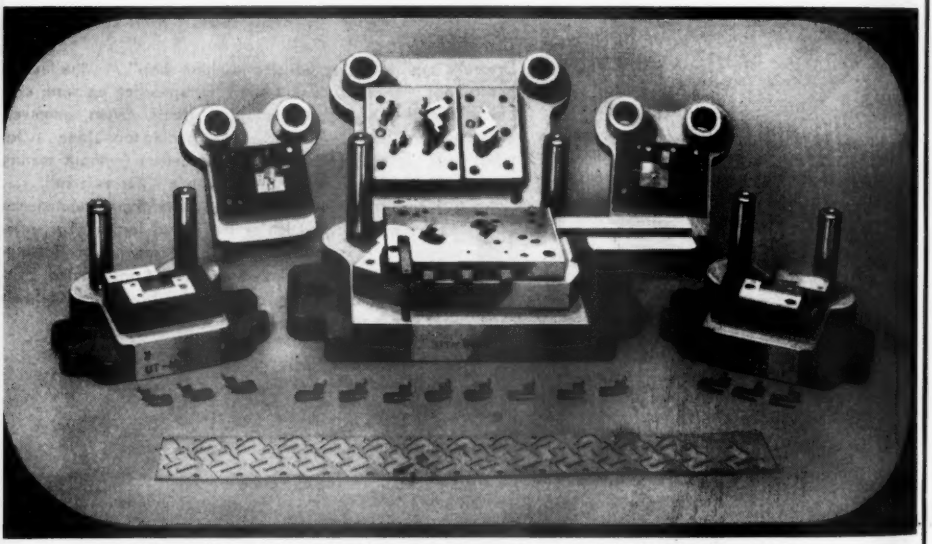

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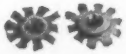

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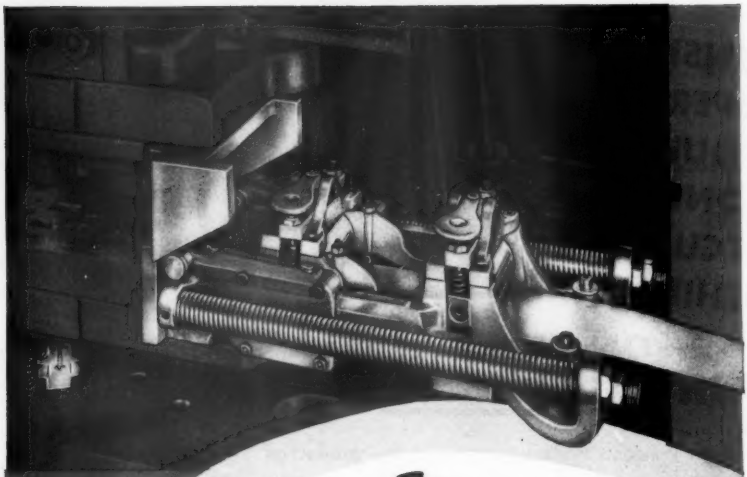

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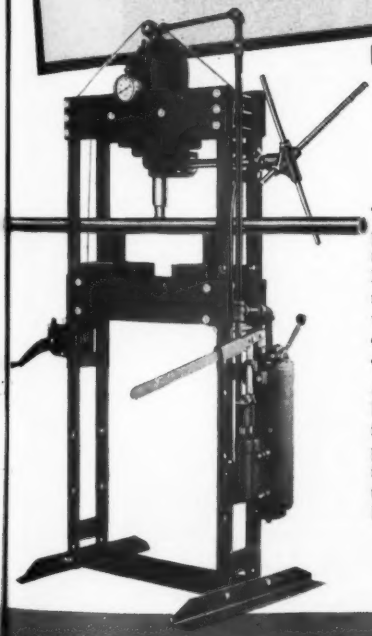

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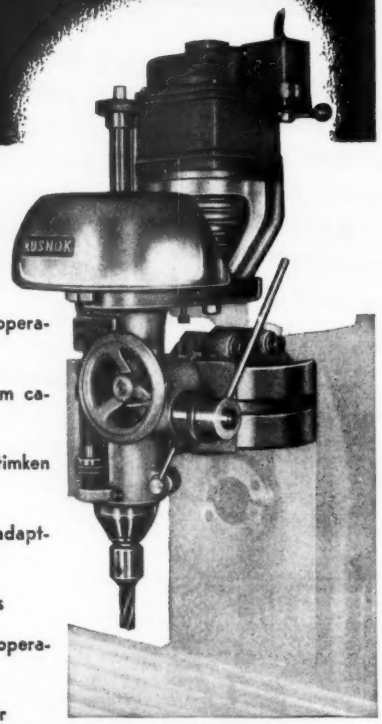


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**6 Rexalloy Cast Non-Ferrous Cutting Alloy**—A folder on Rexalloy tipped tools and tool bits for applications between high speed steels and tungsten carbides. Gives speeds and feeds on various materials, lists bit sizes, and explains economies possible with increased efficiencies.

**7 Steel Analyses**—Handy wall chart, listing analyses of high speed, tool, stainless, alloy, machinery, and special purpose steels.

**8 Data Sheets on Various Steels**—Individual data sheets, punched to fit standard 3-ring binder, available on a full range of grades of the following types of steels:

**High Speed • Hot Work • Die Casting Dies**
**Air, Oil, and Water Hardening Tool Steels**
**Plastic Molding • Alloy • Machinery**

Complete information on analysis, applications, critical temperature, forging, annealing, hardening, tempering, and hardness, together with TTT curves where pertinent. Send for data sheets on all types of steels you use.

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# STEELS

Ask your nearest Crucible branch office and warehouse today for any of the items in this valuable metalworking library to help you in the selection, treatment, and use of Crucible's full range

**High Speed • Tool • Die • Stainless Alloy • Machinery Special Purpose Steels**

All of this steel . . . a full range . . . is of uniformly high quality . . . the result of years of successful experience in producing specialty steels to meet exacting standards of materials and workmanship.

## Got a problem? Call Crucible!

Crucible offers you the personal services of competent metallurgists, mechanical engineers, and other experienced men to help you solve problems in the selection, working, and heat treatment of specialty steels. These services are free, whether or not you are a customer. Just call or write your nearest Crucible branch office and warehouse, listed at the left, and tell them what you're up against.

## Ample Warehouse Stocks

Each of Crucible's 26 branch offices and warehouses carries complete stocks of all sizes and grades of specialty steels normally used in its territory. Your orders get prompt attention. Deliveries are equally prompt. Consider your Crucible warehouse as your main stockroom for the full range of specialty steels, thus reducing your inventories and simplifying and centralizing your buying.

CRUCIBLE STEEL COMPANY of America

**CHRYSLER BUILDING**
405 LEXINGTON AVE., NEW YORK 17, N. Y.

**Crucible Steel Company of America,**
**Dept. K-5, 405 Lexington Avenue,**
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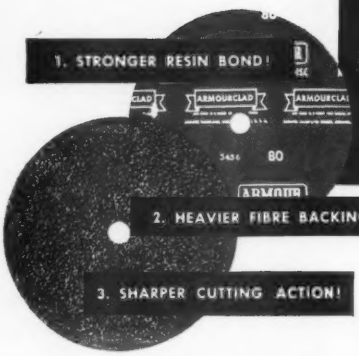


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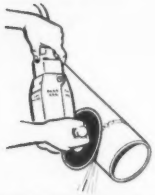
**Now... Faster, more productive metalworking with the New ARMOURCLAD RESIN FIBRE DISC!**

**Actual production tests** have proved that this new disc *cuts faster.* This greater initial rate of cut lowers production costs, reduces labor costs.

**The new Armourclad Resin Fibre Disc** cuts *faster longer* because its special resin bond gives better grain adhesion—greater resistance to heat and humidity.



**Better for all disc operations,** the new Armourclad Resin Fibre Disc is *especially good* for severe grinding jobs.

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**ARMOUR *Sandpaper* WORKS**

*Division of Armour and Company*

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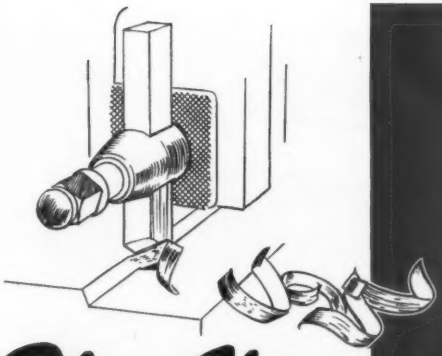
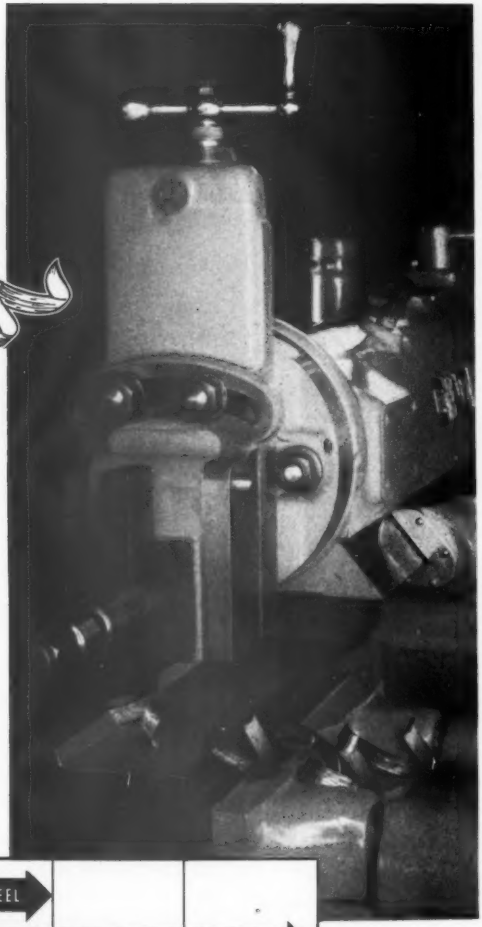


# Blue Chips



Cincinnati Shapers cut blue chips that are profitable chips. Blue chips come from tough die steels that present unusually tough machining problems.

The machine must be accurate in performance, must deliver unusual power at the cutting tool, and must have great stamina. On these things hinges the profitable handling of these tough steels.

Cincinnati Shapers, with their outstanding performance, are found in large numbers in tool and die plants everywhere.

Our representative in your neighborhood will gladly consult with you on increasing accuracy and profit in your shop.

Our Engineering Department is at your service. Ask their advice on your shaping problems.

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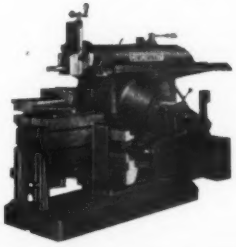

• **THREE TIMES AS TOUGH . . .**
By test, die steels are often three times as tough as mild steel—and machining demands are correspondingly more severe.

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CINCINNATI 25, OHIO U.S.A.
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*Specify* MO-MAX HIGH SPEED STEELS *for your...*

MILLING CUTTERS

*Only* MO-MAX GIVES YOU ALL THESE ADVANTAGES

1. MO-MAX has superior cutting qualities.
2. The machinability of MO-MAX is unexcelled.
3. MO-MAX is economical. Its specific gravity is about 8% less than that of 18% tungsten steel.
4. MO-MAX is available in a standardized composition; also in cobalt and high vanadium varieties for special high speed steel requirements.
5. For 14 years MO-MAX has demonstrated its superiority in all types of cutting tools.

***Learn all the facts!*** Send for your copy of the MO-MAX Handbook, sixth edition. Get the full story about this remarkable steel, including easy-to-follow instructions on heat treating.

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*Buyer's Guide to Brands of* MO-MAX

| | |
|---|---|
| "LAW" | Allegheny Ludlum Steel Corporation |
| "MONCAR" | Atlas Steels Limited |
| "BETHLEHEM MM" | Bethlehem Steel Company |
| "MO-CUT" | Bromberg Alloy Steel Corporation |
| "STAR MAX" | Carpenter Steel Company |
| "MOLITE M-1" | Columbia Tool Steel Company |
| "REX T-MO" | Crucible Steel Company of America |
| "DI-MOL" | Henry Disston & Sons, Inc. |
| "FI-MO" | Firth-Sterling Steel Company |
| "REX T-MO" | Halcomb Steel Company |
| "MOGUL" | Jessop Steel Company |
| "TATMO" | Latrobe Electric Steel Company |
| "MIDMAX" | The Midvale Company |
| "S. T. M." | Simonds Saw & Steel Company |
| "MO-TUNG" | Universal-Cyclops Steel Corporation |
| "D-H-T" | Vanadium-Alloys Steel Company |
| "VUL-MO" | Vulcan Crucible Steel Company |

# *Specify* ATLANTIC

## BAND SAW BLADES

*for*

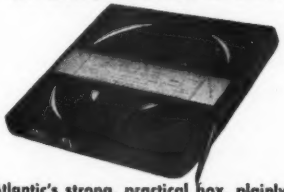
*Smoother*

# CONTOUR CUTTING

ATLANTIC SAWS meet all of your requirements for a superior blade on complicated die and fixture radius cutting. ATLANTIC specializes in accurate milled and precision set teeth, hardened to exact temper.

ATLANTIC'S special alloy steel insures longer wear and easier welding.

ATLANTIC'S one temper saw for all metals reduces stock you have to carry. Cut to length and welded, ready for use. Packed in strong Atlantic box. Write for new Atlantic Catalog.



**Atlantic's strong, practical box, plainly marked on sides and top. Remains in good condition until entire coil is used.**

*Atlantic Saw Mfg. Co.*

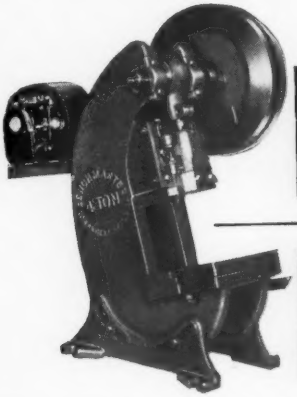
INCORPORATED

**Exclusively Manufacturers of Band Saw Blades**

**160 Brewery St., New Haven, Conn.**

# Benchmaster's* Improved Model

## 4-TON CAPACITY BENCH PUNCH PRESS



*World's largest manufacturer of small presses.

**Small** in Size

**MIGHTY** in Performance

**FOR STAMPING, MARKING, PUNCHING, RIVETING, FORMING AND OTHER HIGH-SPEED OPERATIONS**

Light, compact and powerful, the improved, postwar Benchmaster 4-Ton Capacity Punch Press offers performance formerly found only in far larger models. Its unusual and exclusive features include a cradle base that allows the press to be inclined, a precision-ground shaft keyed by a press fit to a large eccentric to provide shock-absorbing bearing surface, bronze bushings at all wear points, a single trip action that may be made to repeat rapidly by removing a screw located in the collar, automatic knockout, an open back so that work may also be inserted from the front, a new-type floating motor mount which maintains proper tension of the V-belt, standardization of parts for quick, easy interchangeability and many other typical Benchmaster improvements.

For full information about this new Benchmaster Punch Press and other quality Benchmaster machine tools, write to Dept. TDJ-5.

**SPECIFICATIONS:**

Weight, 215 lbs.
Height, 27"
Die space, 5¾"
Center of bolster plate to frame, 3⅜"
Bolster plate, 6" x 8" x 1" with 2" hole in center
285 strokes per minute with 1725 R.P.M. electric motor
1" stroke standard
Other strokes up to 2" special

benchmaster MANUFACTURING COMPANY
2952 WEST PICO BOULEVARD
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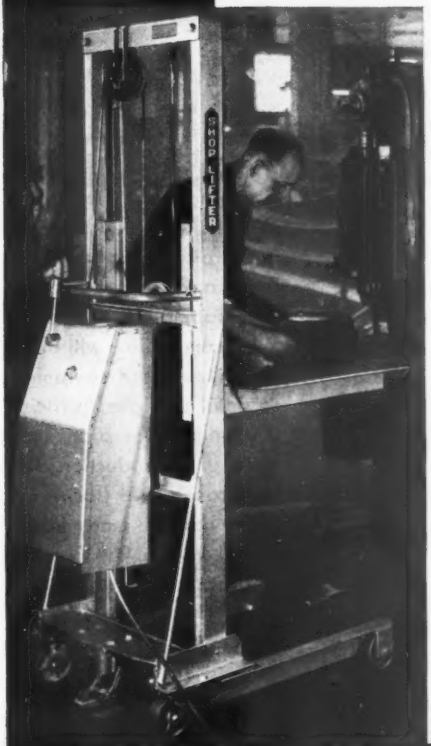
benchmaster tools

# NOW the ELECTRIC SHOPLIFTER

## Industry's favorite all-purpose lifter now powered for continuous duty service




The electric SHOPLIFTER has been engineered for those continuous duty jobs where a hand operated hoist is impractical or unduly tiring to the operator. To operate the lifter, plug the conductor cord into the nearest lamp socket, then turn the controller handle to the "up" or "down" position—that's all there is to it; the power unit does the lifting. Anyone can operate the electric SHOPLIFTER with perfect safety and without fatigue.

Motor—1/3 horsepower reversing type, built to NEMA specifications, 110 volt, single phase, 60 cycle AC, for lamp socket operation only. Platform speed—10 feet per minute.

Platform—steel plate, 24" x 24". Overall height—6'0". Platform lift—4'6".

Price—Complete machine, $397.50 f.o.b. Chicago with freight allowed. (Foot operated Floor Lock $10.00 extra). Hand operated SHOPLIFTER, $157.50.

Other Economy Lifting Machines of heavier capacities up to 5000 lbs. available.

***PROMPT DELIVERY***

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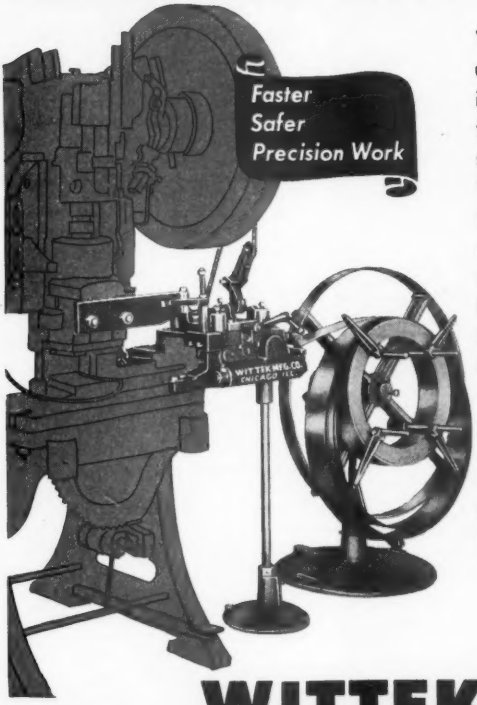
*Planning Peacetime Production Using Coiled Strip Stock?*

## Equip with
# WITTEK
## *Automatic* Roll Feeds and Reel Stands




Wittek Roll Feeds are being used extensively by war plants in their large volume production of high quality metal stampings. The flexibility of Wittek Roll Feeds will assist these plants in their peacetime conversion through their adaptability to various jobs. Keen competition will demand the utilization of equipment to its point of highest efficiency. If your postwar plans include punch press production of parts from coiled strip stock—investigate now the many possibilities of Wittek Roll Feeds and Reel Stands.

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AND
REEL STANDS

## DESIGNING and BUILDING SPECIAL MACHINES, TOOLS and DIES *to do a Particular Job*

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*You will be interested in a booklet "Men and Machines"—a copy is yours upon request.*

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# SPRINGFIELD PRECISION TOOL ROOM LATHE

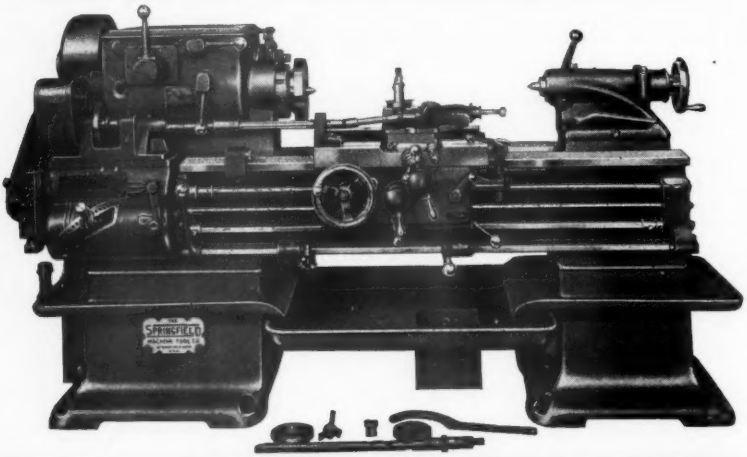
## *"A Master Lathe for Master Craftsmen"*

**The Springfield Precision Tool Room Lathe is engineered and constructed to the most exacting requirements. Its superior design features have been developed through more than sixty years' experience in building precision machine tools.**

**The powerful Headstock provides twelve spindle speeds. No more than seven of its chrome Molybdenum hardened *ground* gears are in mesh at one time. Timken Precision Taper Roller Bearings in solid headstock housings insure permanency of spindle alignment and long life. All bearings and gears are spray lubricated by cooled oil from the large reservoir in the leg.**

**The semi-steel Apron is of extra-heavy, box construction and is completely ball and bronze bearing-equipped. The Taper Attachment is capable of very fine, micrometer screw adjustment. The sturdy Compound Rest is a heavy duty, square base type providing full 360° swivel. The Tailstock, massively designed, has large centers and exceptionally long spindle travel.**

**ASK US FOR *YOUR* COPY OF BULLETIN 162 which illustrates and describes the features of the Springfield Precision Tool Room Lathe and gives detailed specifications.**




# THE SPRINGFIELD MACHINE TOOL CO.

SPRINGFIELD • OHIO, U. S. A.

# Empco JACKS

## TO SET AND KEEP YOUR MACHINES LEVEL

To lower, turn screw to left.

To raise, turn screw to right.

## 3 SIZES

No. 1—2" normal height
No. 2—2⅝" normal height
No. 3—3⅛" normal height

## SELF-ALIGNING, SMOOTH, ACCURATE, POSITIVE ADJUSTMENTS!

Machine Tool Manufacturers strongly emphasize the need, not only to set machines level, but to keep 'em that way. Periodic re-leveling is essential for accurate work tolerances. How often, depends on the type of foundation. No method of machine setting is stable enough to maintain the accuracy of initial leveling. It is important to check after first month of operation, then check periodically and re-level whenever necessary. When a machine is set on EMPCO JACKS, the whole operation is the work of but a moment: Simply apply a wrench to the "hex" screw head, turn right or left until your level indicator reads "zero."

EMPCO

**THE ENTERPRISE MACHINE PARTS CORPORATION**

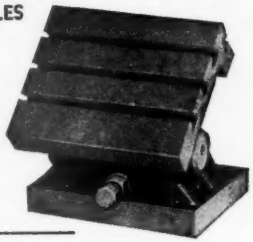
2735 JEROME AVE. DETROIT 12, MICH.

# TOOLS *for* PRECISION PRODUCTION

## ADJUSTABLE ANGLE PLATES

MODEL "A"

FOR MACHINING AND GRINDING ANGLES



These Angle Plates are made of the best grade of gray iron, machined and ground true with the holes, all steel parts are hardened and ground.

MODEL "A" has four $\frac{3}{16}$" "T" SLOTS, 3 on the face side and one "T" Slot on the top when set at 90°. The size of this plate is 3 x 3 x 3¾. Shipping weight 5 lbs.

NET PRICE **$16.85**

## DRILL JIG BUSHINGS

A. S. A. STANDARD

- SLIP RENEWABLE
- FIXED RENEWABLE
- LINERS
- HEADLESS PRESS FIT
- HEAD PRESS FIT
- HEAD TYPE LINERS

***SIMPLIFIED ORDERING***

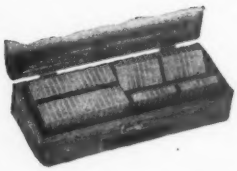
**Specify drill size, O. D., and length in order named. Also bushing number. Bushings above 1¾" hole size will be quoted upon request. In ordering special bushings, forward blueprint showing all dimensions and limit.**

**These Drill Jig Bushings are made of high grade tool steel—Rockwell C 62 and 64 hardness.**

***Special length bushings carried in stock in blank form.**

## MAGNETIC BLOCKS

FOR SURFACE GRINDERS



This universal set consists of two parallels 1" x 1¾" x 3¾", and two V-blocks 1¾" x 2⅜" x 1⅞". This set has been especially designed for holding various types of work that cannot be placed directly on the magnetic chuck. Complete in Hardwood Case.

**$17.50** SET

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## ACME TOOL COMPANY

96 WARREN STREET • NEW YORK 7, N. Y.

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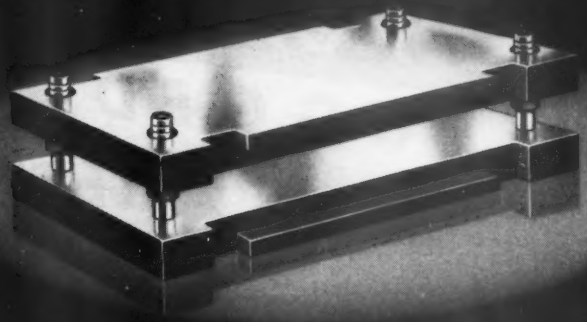

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Product of more than 50 years of specialization in the manufacture of band sawing machinery the TANNEWITZ 24M is the machine that will enable you to capitalize to the fullest extent on the economies of contour sawing, inside and outside filing and polishing. It's rugged, with every detail of construction thoroughly proved, — TROUBLE-FREE. And it carries full 24-inch wheels which make for easier, straighter sawing. For complete details write for DI-SAW Bulletin.

**FRICTION SAWING** with Tannewitz High Speed Band Saws offers many amazing advantages. Write for free booklet.

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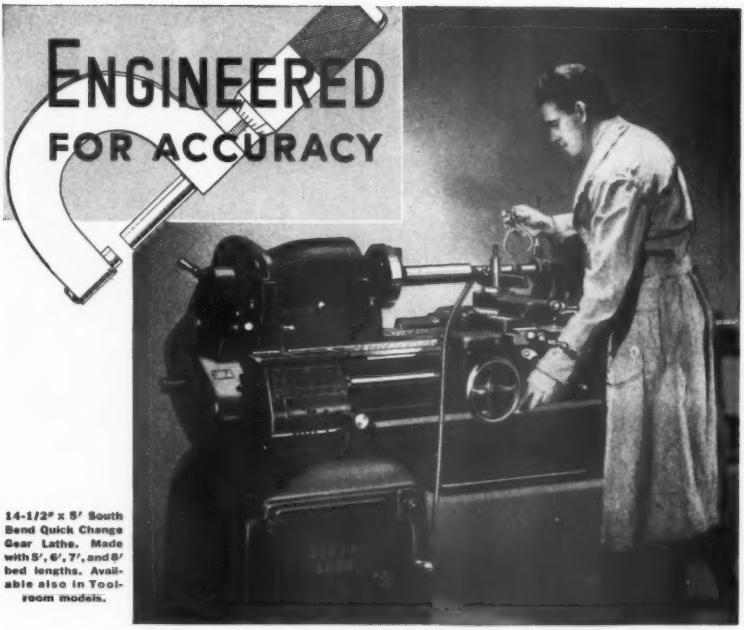

14-1/2" x 8' South Bend Quick Change Gear Lathe. Made with 5', 6', 7', and 8' bed lengths. Available also in Toolroom models.

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**South Bend Attachments and Accessories simplify and speed tooling, often save delay and expense of making special fixtures. Write for illustrated Catalog No. 77 which shows the complete line of South Bend Attachments and Accessories.**

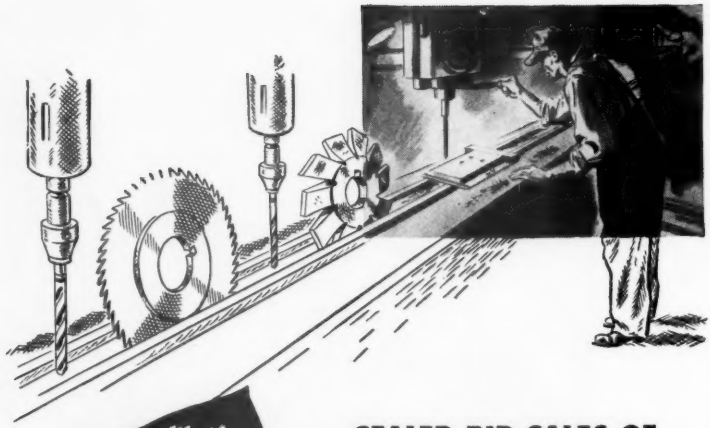
South Bend Lathes are engineered to meet exacting needs for precision accuracy in all types of industries, and to maintain their accuracy year after year, even under strenuous production conditions. Accuracy and long life are built into South Bend Lathes as carefully and surely as they are built into fine timepieces. Correct design based on nearly forty years of research and experience, quality materials specially selected for specific needs, expert craftsmanship, strict inspection through all phases of production and assembly, and thorough testing to rigid working tolerances before shipment, guarantee dependable performance in the laboratory, toolroom, and production shop.

South Bend Engine Lathes and Toolroom Lathes are made with 9", 10", 13", 14½", and 16" swings, and bed lengths to 12'. Turret Lathes are made with collet capacities to 1". Write today for free 68-page catalog which illustrates all sizes and models, gives detailed specifications, and shows all attachments and accessories. Ask for Catalog 100-D.

*LATHE BUILDERS SINCE 1906*

**SOUTH BEND LATHE WORKS**

**432 EAST MADISON STREET • • SOUTH BEND 22, INDIANA**



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$54,000,000 worth of cutting tools are available now to you in the metal working industries who act quickly. Thousands of types to choose from, prompt delivery, and bargain prices to those who inquire, inspect and invest. The inventory includes: cutting tools for machine tools, metal turning tools for metal turning machines, accessories and attachments for machine tools, and tool room specialties in all sizes and types.

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Sales of cutting tools will be held at frequent intervals. The entire inventory will be sold on a sealed bid basis and while every regional office has a stock of cutting tools, the largest inventories are located in these cities.

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# T-J CUTTERS

*for top speed work in tough die steels*

Do your cutting in tough die steels—at *high speed*—with T-J Die Sinking Milling Cutters! Designed and built *right* for sturdiness . . . ability to hold a sharp edge longer . . . and carry less breakage percentage. *More work between grinds!* Made from a standard, extremely high grade steel . . . *better performance* because of extra strength, wear resistance and uniformity. Backed by 29 years of T-J experience. Write for catalog. The Tomkins-Johnson Company, Jackson, Michigan.

FOR TOUGH JOBS SPECIFY T-J

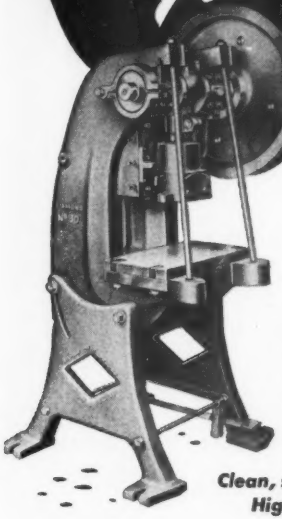
**TOMKINS-JOHNSON**

**DIE SINKING MILLING CUTTERS**

# First Choice FROM ALL ANGLES

...design
...workmanship
...performance

## Diamond OPEN-BACK INCLINABLE PUNCH PRESSES



in 9 14 30 Ton Ratings

| QUICK SPECIFICATIONS | | | | |
|---|---|---|---|---|
| Model | Standard Stroke* | Shut Die Height | Frame Opening | Flywheel Speed |
| 9 Ton | 1½" | 7" | 5½" | 185 max. |
| 14 Ton | 2" | 9" | 6½" | 150 max. |
| 30 Ton | 3" | 9" | 10½" | 125 max. |

* Longer strokes available upon special order.

***Clean, streamlined appearance • Careful craftsmanship***
***High speed performance • Safe, easy operation***

DIAMOND PUNCH PRESSES are among America's *finest* machine tools...Sleek and trim, yet designed for amazing strength. High overload capacity. Smoothly finished and accurately fitted in every detail. Production tolerances so close that parts are uniformly interchangeable!

***If you want to punch holes in your production quotas, see these improved Diamond Punch Presses!*** **Available from dealers throughout the nation.** ***Write for FREE circulars!***

**FEATURES**

**CRANKSHAFT**—Chrome nickel steel—precision ground all over. Bearing surfaces finished to 20 micro-inches.

**RAM**—Bearing surfaces precision jig-ground, hand scraped for individual fit. Exclusive floating-type fully universal ball screw and nut maintains close alignment over full ram stroke.

**GIBS**—Precision sliding surfaces ground to 20 micro-inches.

**CLUTCH**—Positive, instantaneous contact with three sets of pins engaging flywheel.

**FLYWHEEL**—Extra heavy for smooth operation and maximum energy. Mounted on oversize bronze bushing.

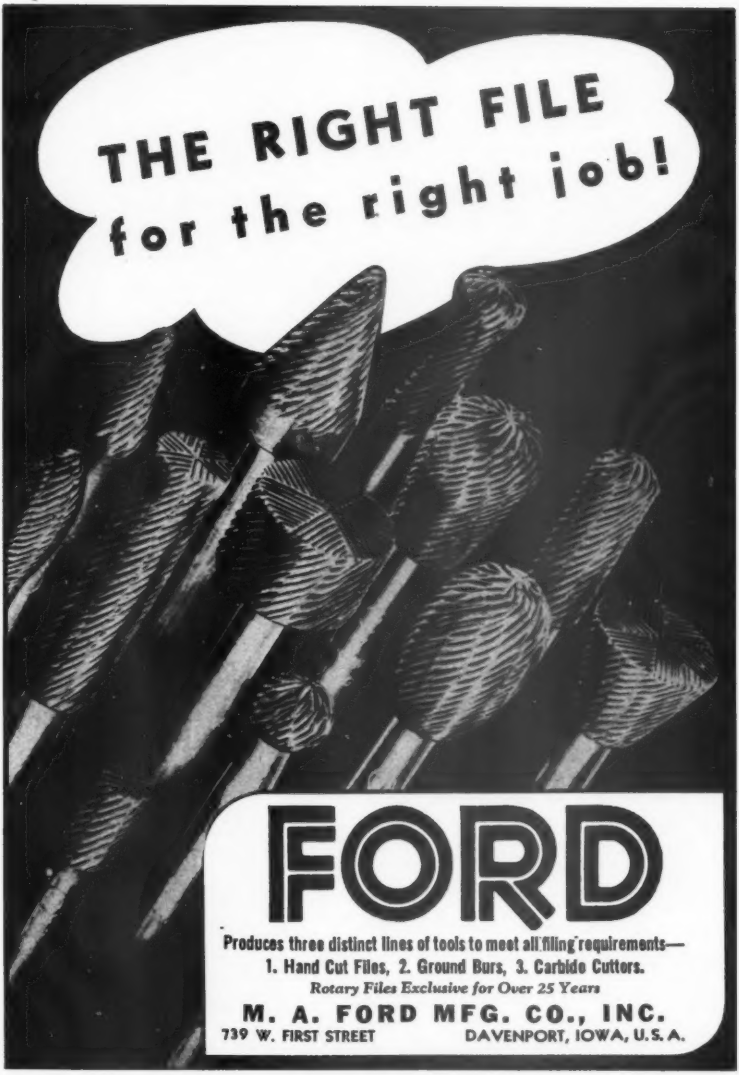
**FRAME**—Massively constructed semi-steel castings, correctly designed for high overload protection.

## DIAMOND MACHINE TOOL CO.

Dept. G • 3429 E. Olympic Blvd. • Los Angeles 23, Calif.

DIAMOND DTCo

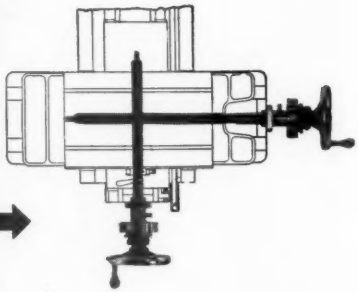
MANUFACTURERS of the DIAMOND LINE of PRECISION MACHINE TOOLS and ACCESSORIES


THE RIGHT FILE
for the right job!
FORD
Produces three distinct lines of tools to meet all filing requirements—
1. Hand Cut Files, 2. Ground Burs, 3. Carbide Cutters.
Rotary Files Exclusive for Over 25 Years
M. A. FORD MFG. CO., INC.
739 W. FIRST STREET
DAVENPORT, IOWA, U.S.A.

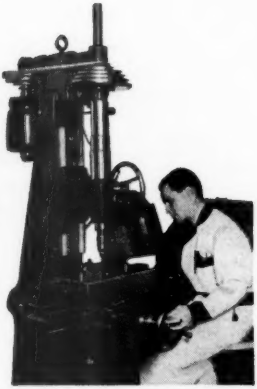
## 15 holes in 15 minutes

**Spotted, Drilled and Reamed to ±.0002* by the Coordinate Hole Location Method***

...because Micrometer Lead Screws Accurate to .0002" in 16 inches



...Speed Table Settings on the **MOORE JIG BORER**

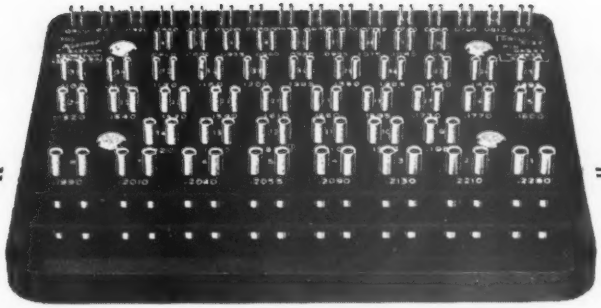


* One boring cut to increase accuracy to ±.0001" required only five minutes additional time for all fifteen holes. Write for descriptive literature.

MOORE TOOLS

**MOORE JIG BORER**

MOORE SPECIAL TOOL CO., INC., 726 Union Avenue, Bridgeport 7, Conn.



# DRILL SIZE PIN GAGES

## Class Z Accuracy

**LETTER SET**—52 gages in 26 pairs from A to Z. $45 set.

**FRACTION SET**—60 gages in 30 pairs in steps of 1/64" from 3/64" to 1/2". $50 set.

**NUMBER SET** — 120 gages in 60 pairs from 1 to 60, $90 set.

All sets include stands . . . Prices F.O.B. Bridgeport, Conn.

$1 EA any size

- Polished Radius Top
- TOLERANCE +.0001 —.0009
- Overall Length 1½"
- LOWER HALF CONCENTRIC TAPERED for easy insertion
- Oil Hardened Tool Steel
- Flat Ground Bottom

Sets in pairs of gages for checking any number of similar holes. Stands have 3 plates and cover so that gages stand upright. Drill size is plainly stamped in front of each gage hole, together with decimal equivalent to the ten thousandth of an inch.

## IMMEDIATE DELIVERY — 116 SIZES

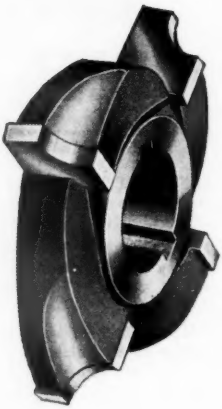
Check or M.O. should include .08c postage for quantities less than Set. Sets shipped Express Collect. No C.O.D.'s.

THE *Horberg* GAGE COMPANY

19 STAPLES STREET, BRIDGEPORT 1, CONN.

# Meyers Carbide Tipped Formed Tools

## For Your *Special* Requirements



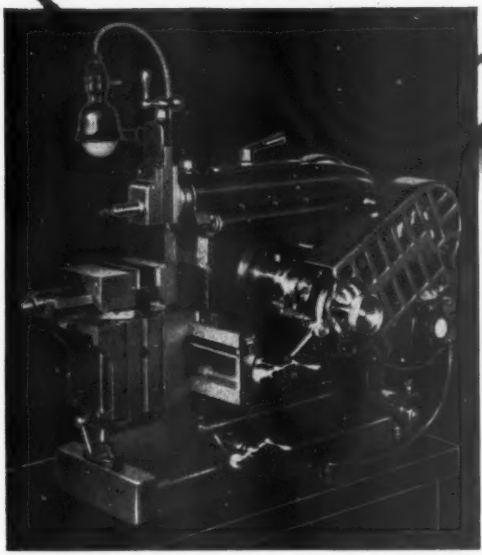
On actual production runs, Meyers generated Carbide Tipped Tools have boosted production more than 500%.

This amazing increase was due to use of special Meyers equipment designed and engineered by our Engineering Department. Increased costs force you to get the most out of your machine tools—Meyers generated carbide tipped form tools will give you more pieces per hour—more pieces between grinds—and a much smoother finish. Let us help you improve your production and cut your costs. Send us your prints for quotation.

**W. F. MEYERS COMPANY, INC.** • *ESTABLISHED 1888*

1016 FOURTEENTH STREET • • • BEDFORD, INDIANA

# *Yes Sir — for all kinds of Precision Work LOW PRICED AMMCO 7" SHAPER is a honey!*



**AMMCO 7" SHAPER—Bench Model**

with swivel vise and wrenches, including 4 step V-pulley, adjustable countershaft, motor driven pulleys, 2 V-belts, adjustable lamp and switch. Belt guards and motor, extra. Net weight 175 lbs., shipping weight 225 lbs.

**AMMCO 7" SHAPER—Portable Cabinet Model**

complete with swivel vise and wrenches, including 4 step V-pulley, adjustable countershaft, motor driven pulleys and 2 V-belts, with belt guards; ⅓ H.P. Motor, 110 Volt, 60 Cycle, single phase and with overload switch; mounted on a maple cabinet with casters and handle for portability, and including adjustable lamp, completely wired and ready for operation. Net weight 300 lbs., shipping weight 400 lbs.

## IT SAVES TIME...LABOR... CUTS PRODUCTION COSTS WAY DOWN

You can take it from me, our AMMCO 7 inch SHAPER is doing a job for us that saves time, cuts down production costs, makes money for us like no other shaper ever has.

There isn't a big machine that surpasses it in accuracy. It saves you time, floor space and expense in set-up operations . . . uses less electricity, is the perfect shaper for jobs requiring a 7 inch stroke or less.

At its low price, it's a buy you can't beat . . . precision guaranteed because AMMCO *builds the skill into the machine!*

Write now . . . today for specifications and prices. Address Dept. TD-57.

**AMMCO TOOLS, INC.**

COMMONWEALTH AVENUE — NORTH CHICAGO ILLINOIS

(Formerly Automotive Maintenance Machinery Co.)

**THE SKILL IS BUILT INTO AMMCO MACHINES**

# NOW A MOLDMAKER'S TOOLROOM LATHE

## WITH A *PLUS* FOR PLASTICS MOLDMAKERS

*A complete range of lead variations*—you can set your machine for any one of them in exactly one and one-half minutes!

Compare that performance with a normal toolroom lathe's—and change gears requiring thirty minutes to change. Think what you'll save on production time—and on original investment in change gears, too—especially if any sizable share of your production is thread molds for plastics.

Principal among the patented features of this new Monarch moldmaker's toolroom lathe is the adjustable leadscrew variating mechanism—a device that makes it a simple matter to compensate for the shrinkage of the material to be molded. Plastic thread molds become a mere routine production operation.

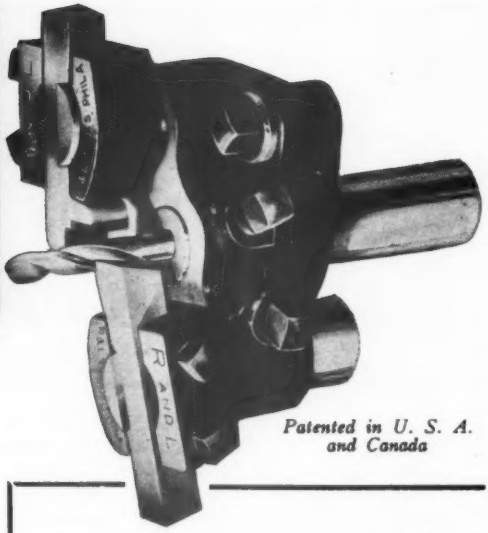
Then there's a speed-reducer—that permits slowing down to a *fraction of a revolution a minute* for internal and external milling operations, performed at a single setting of the mold in the lathe.

Add to these the features built into every Monarch toolroom lathe (and the machine is equally adaptable for normal toolroom work)—features that have a proved record for precision and long life. The result is a machine you can't afford to be without if you have any plastics production. Like more facts? Ask for specification sheet 405—or call your nearest Monarch representative.

ACCURACY · ECONOMY · LONG LIFE
Monarch
TURNING MACHINES

**THE MONARCH MACHINE TOOL CO. · SIDNEY, OHIO**

# ONE COMBINATION R and L TURNING TOOL *Will Do The Work Of All These For Either Right or Left Hand Operations*




*Patented in U. S. A. and Canada*

- **Roller Box Tool**
- **Centering and Facing Tool**
- **Knee Tool**
- **Pointing Tool**
- **Back Rest**
- **Floating Drill Holder**
- **Balanced Turning Tool**

**Fourteen tools are combined in one R and L (right and left) Combination Turning Tool, the only combination right-hand and left-hand tool on the market.**

**You can change an R and L Combination Turning Tool from right to left or vice versa in a matter of only ten seconds.**

## YOU WILL APPROVE THESE OUTSTANDING FEATURES

- **Made of extra tough, heat treated alloy steel; unconditionally guaranteed not to bend or give way**
- **Essential parts ground to extreme accuracy affording perfect alignment at any point of adjustment**
- **Back Rests, or burnishers, have almost diamond hard surfaces eliminating metal pick-up and marring of work surface**
- **Interchangeable Roller Back Rests furnished if desired**
- **Precise adjustment on both cutting tool and pressure of burnishers**
- **Tool bits wear longer because they are ground only on top side, or end**
- **Less cross-slide clearance required; saves time and often permits working with cross-slide tools while turning or drilling**
- **On turnings, the R and L Combination Tool produces highly polished surfaces, true to size, and straight**
- **Usable either for roughing or finishing; extra heavy cuts possible because thrust is always in direct line with Back Rest**
- **Longitudinal adjustment permits turning of two diameters to any length within tool capacity**

**All these and many other features are shown by photographs in drawings in descriptive booklet mailed without cost or obligation. The booklet illustrates the tool set-up for various operations, and indicates speed and simplicity of its adaptation to various jobs. Prices and full specifications of many available sizes are included. Write for your copy today.**

# R and L TOOLS

**1825 Bristol Street**
**Philadelphia 40, Pennsylvania**

# CUTS TWICE AS MUCH STOCK . . . . REDUCES BLADE COST 75%

**SawMore**
**METAL CUTTING SAWS**

Actual running conditions proved the installation of SawMore Machines cut a manufacturer's* blade cost 75%. This was accomplished by SawMore Machines handling more than *twice* the amount of stock cut by previous saws. Materials that usually meant high blade cost . . . materials ranging from new to used stock including I beams, channel, pipe, tubing, bar stock, flats, etc.

Enthusiastic users the nation over have found that SawMore Machines improve work quality—lead the way in extremely high cutting accuracy . . . slash production costs.

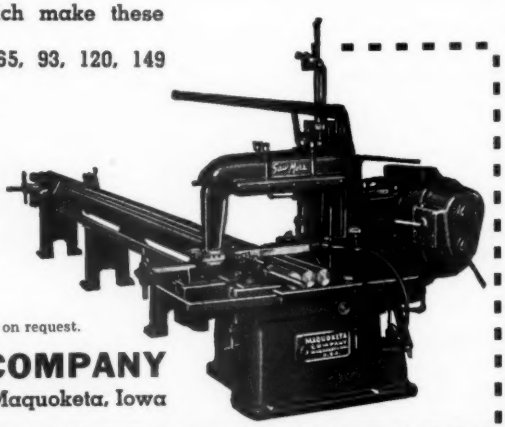
SawMore features which make these records possible are:

- 4 cutting speeds — 65, 93, 120, 149 strokes per minute
- Self-aligning blades
- Automatic feed
- Gears in constant mesh—reduce back lash to minimum
- Spacer Bar which may be set for individual or multiple length.

*Name of manufacturer sent on request.

**Immediate Delivery**

**Write for new *free* catalogue**



**MAQUOKETA COMPANY**
Maple Street Maquoketa, Iowa

# HEAT TREAT SMALL PARTS

## *In Your Own Plant*

- Install anywhere by simple wire connection. Quiet in operation. No fumes or odors—no ventilating required.
- Any intelligent man can operate furnace with automatic temperature control, using established procedures.
- Operating cost under 4¢ per hour to hold 1600° F. in Model 3 furnaces, with 2¢ per kw.-hr. rate. Others in proportion.
- Models 3 and 4 furnaces heat from cold to 1400° F. in 40 min. or to 1850° F. in 55-65 min. Model VK-5 heats to 2000° F. in 2½ hrs. Half this time required after overnight shut-down.

**NOW YOU CAN** heat treat, harden and temper small parts in your own plant . . . *without experienced heat treaters.* Economical to install and use, Cooley Electric Furnaces operate efficiently at high or low heats, and save your large furnace time for work requiring large volume capacity. Here are some profitable uses:

**PRODUCTION HEAT TREATING** of small parts . . . Small batches . . . Running pilot lots to predetermine mass production techniques . . . Emergency repairs . . . Industrial and laboratory testing . . . Miscellaneous controlled heating jobs.

**PROTECTED, REMOVABLE ELEMENTS**

Nickel-chromium resistors are embedded in 4 refractory blocks which form the chamber walls. This reduces chemical deterioration from exposure to air . . . protects elements from physical damage . . . assures uniform heating by maintaining correct coil spacing. Units are quickly removable without dismantling furnace.

| CHAMBER | 8"W 6"H 14"L | | | | 10"W 8"H 18"L | | | | 8"W 6"H 14"L |
|---|---|---|---|---|---|---|---|---|---|
| FROM COLD | 1850° F. in 55-65 min. | | | | 1850° F. in 55-65 min. | | | | 2000° F. in 2½ hrs. |
| AMPERES | 14.8 at 230 v. | | | | 19.6 at 230 v. | | | | 20.2 at 230 v. |
| WATTS | 3400 | | | | 4500 | | | | 4650 |
| MODEL* | MH-3 | VH-3 | MK-3 | VK-3 | MH-4 | VH-4 | MK-4 | VK-4 | VK-5 |
| PRICE | 146.00 | 166.00 | 186.00 | 206.00 | 222.50 | 242.50 | 262.50 | 282.50 | 340.00 |

* M models complete with hinged door and hearth plate.
V models have counterweighted vertical lift door with adjustable opening.
K models include Selective Power Modifier for input control to correct temperature lag.

### ACCESSORY EQUIPMENT

Electronic operated Veri-Tron indicating and controlling pyrometer, with thermocouple and lead wire ..... $143.00
Same in self-contained, enclosed panel including line switch and fuses, with steel stand—completely wired ..... 240.00
Steel stand with shelf ..... 35.00

**DEALERS AND DISTRIBUTORS WANTED!**

Good territories open on this extensive line of self-contained small electric furnaces. Investigate now.

**FREE HEAT TREATING HELP**

Our experience in heat-treating is available to you. State your problem . . . write for free literature today—no obligation.

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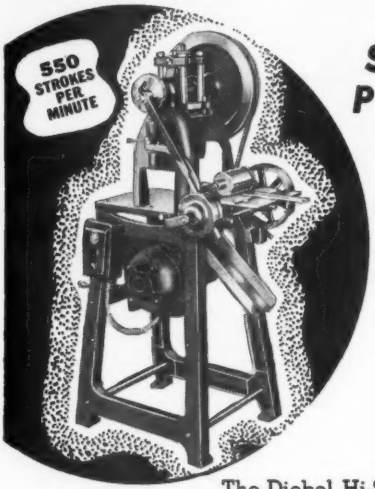
32 South Shelby Street Indianapolis 7, Indiana
INDIANAPOLIS MACHINERY EXPORT CORP.
Export Manager, 44 Whitehall Street, New York, New York

# DIEBEL

## Hi-Speed 550 R.P.M. AUTOMATIC PRESS




**STEPS UP PRODUCTION**

**CUTS COSTS**

***on all Small Stampings***

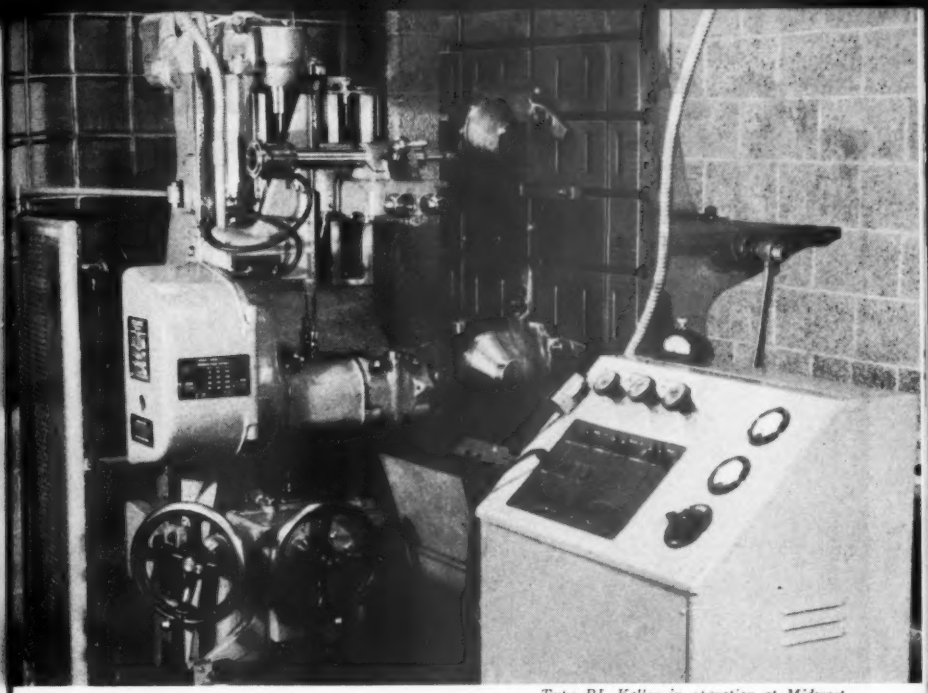
METAL
PLASTIC
FIBRE
PAPER
RUBBER
LEATHER

The Diebel Hi-Speed Punch Press requires less floor space—less power—increases production—is safer—releases heavier presses for other production.

Remember—this versatile Hi-Speed Automatic Press is adjustable up to 550 strokes per minute!

***WRITE TODAY FOR ILLUSTRATED LITERATURE***

**DIEBEL MACHINE CORP.**
DIVISION OF DIEBEL DIE & MFG. CO.
2713 West Irving Park Road Chicago 18, Illinois



*Type BL Keller in operation at Midwest*

# *A Specialty*

## . . . KELLER MACHINE WORK

**A Specialty in a Specialist's shop—our complete metalworking facilities include a Keller machine capable of producing extreme precision work from models or machining the most intricate shapes and forms.**

**The Midwest Keller service is ready to handle the accurate machining of all types of dies and punches for blanking, trimming, piercing and extrusion, forging, stamping and die casting dies, plastics molds, cams, templates, gages, jigs and metal patterns.**

**The experienced engineers in our designing department can take your Keller machine requirements in the blueprint stage and Midwest will carry into final production including thorough testing and inspection.**

**Midwest Tool & Engineering Co. provides a complete tooling service—original designing and engineering as well as all facilities for the manufacture of tools, dies, jigs and fixtures, and the building of special machines designed to do your specific job faster, better and at lower cost.**

***We invite your inspection.***

**Write today and include blueprints for quotation and dependable delivery schedule.**

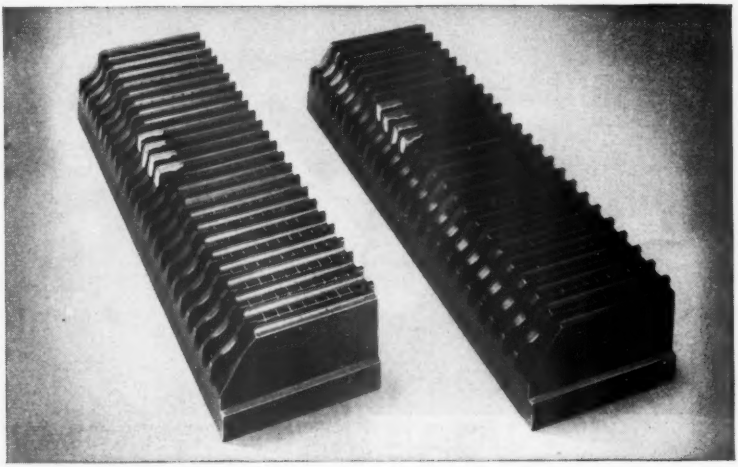
**TOOLING SPECIALISTS**

# Midwest

## TOOL AND ENGINEERING COMPANY

612-620 Park Avenue • Indianapolis, Indiana

# $825 WORTH OF BROACH INSERTS REPAIRED AT COST OF ONLY $10



## Cutting tool life greatly prolonged with use of Eureka No. 2 H.S.S. welding rods . . .

The large high-speed steel broach inserts pictured above, valued at about $825, were rendered useless because of four broken corners in the cutting flutes. Yet these same inserts were quickly repaired by welding and at a cost of only $10! The answer? *Eureka No. 2 H. S. S. welding rods!* Cutting edges were built up, then finish ground and the inserts were as good as new! Deposits of Eureka No. 2 are "hard-as-welded", have excellent cutting characteristics and abrasive resistant qualities which are often better than typical high-speed steels. No subsequent heat-treatment necessary.

Eureka No. 2 H.S.S. welding rods are now being widely used for *repairing* or *compositely fabricating* H.S.S. *cutting tools* and for *creating cutting, wearing and bearing surfaces.* Saves time, money, man hours! Write for literature now!

EUREKA WELD ELECTRODES LOCK THE FINEST STEELS

*Welding Equipment & Supply Co.*

MEMBER AMERICAN SOCIETY OF TOOL ENGINEERS

**PIONEERS IN TOOL AND DIE WELDING ELECTRODES**

225 Leib Street • Detroit 7, Michigan

Increase PRODUCTION

Reduce TOOL COSTS

Improve PRODUCT QUALITY

WITH THE

# CLEVELAND CIRCULAR RELIEF GRINDER

## A PRECISION MACHINE FOR RELIEF GRINDING ALL MACHINE TOOLS

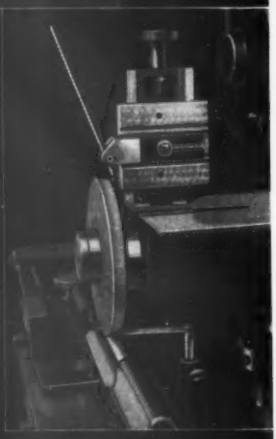
Now you can regrind reamers, taps (including bent shank models), milling cutters, form tools, boring heads, etc., with either straight or spiral flutes, straight or tapered on a single machine.

Quickly and easily set-up for circle grinding, flat relief grinding, surface grinding, grinding the entering and breaking angle and the back taper on all machine tools. Calibrated hand wheels for direct reading for all adjustments.

## SIMPLIFIED CIRCULAR RELIEF GRINDING . . .

Leaves no land . . . delivers from 3 to 5 times more wear per grind. Grinding wheel is dressed to the curvature of the cutting edge, the tool offset for clearance, and ground clear to the cutting edge . . . in one pass.

WRITE TODAY FOR COMPLETE DATA



GRINDERS & FIXTURES, INC.

1261 WEST 4th STREET • CLEVELAND 13, OHIO

# Jack of all Trades...

## CINCINNATI UNIVERSAL SPIRAL MILLING ATTACHMENT

Drilling the end of a large part, using the longitudinal table feed

Vertical milling operation with a shell end mill

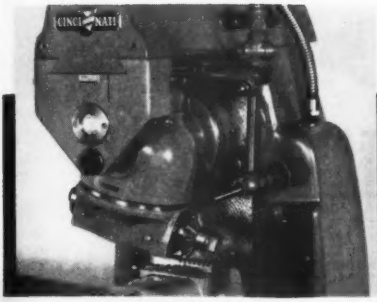
Milling a dovetail with a helical end milling cutter

CINCINNATI

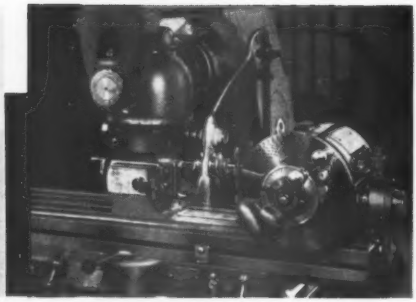
**THE CINCINNATI MILLING MACHINE CO.**

CINCINNATI 9, OHIO, U. S. A.

MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES



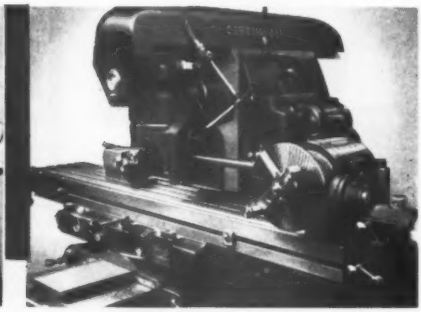
The double swivel arrangement is used to advantage in milling the teeth of this broach insert



Milling a worm, on a CINCINNATI Miller equipped for short leads

● A veritable jack of all trades, the CINCINNATI Universal Spiral Milling Attachment is master of them, too. It greatly extends the versatility of CINCINNATI Plain and Universal Millers . . . in the toolroom . . . in the production line. A few of its many uses are shown here. ¶ The attachment can be swiveled 360° in two planes; has a one to one spindle speed ratio; No. 10 B & S taper hole in the spindle; can be easily set up and removed as desired. Complete details will be found in catalog M-804-1.

Setting up the Universal Spiral Milling Attachment



Here, a special spindle carrier acts as a "follower" to support the work under the cutter

# these FIRTHITE tools

## will do 85% of your machining jobs!

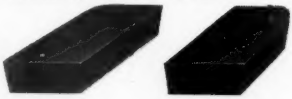
### GENERAL PURPOSE TOOLS
Grades HA, TA & TO4

### MASONRY DRILLS
Grades H & HA

PROMPTLY AVAILABLE FROM STOCKS

use STANDARD
**FIRTHITE TIPS to make your own special tools**

Grades H, HA, TO4, TA, T83 & T16



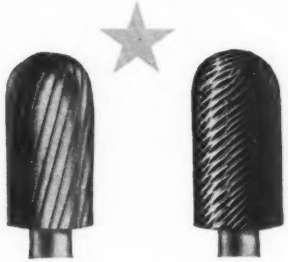
**A wide coverage of tips and tools to meet practically all of your regular machining needs. Prompt shipments from adequate stocks at minimum prices. Readily adaptable by simple hand grinding to fit your specific requirements.**

Call **Firth Sterling**

STEEL & CARBIDE CORPORATION

McKEESPORT, PA. • NEW YORK • HARTFORD • PHILADELPHIA • PITTSBURGH • CLEVELAND • DAYTON • DETROIT • CHICAGO • LOS ANGELES

# FOR REGULAR DUTY



**Ground (Bur) and Hand Cut (File) Types** —with ¼" shanks. Each made in 16 standard shapes; 3 cuts (Coarse, Medium, Fine); ⅛" to 1⅛" stock diameters.

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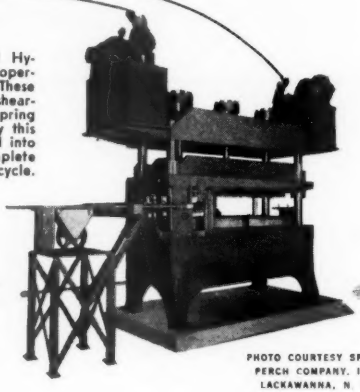

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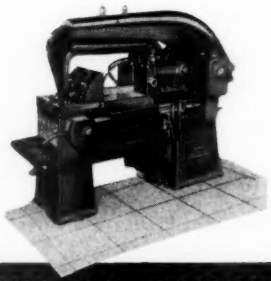


RACINE

STANDARD FOR QUALITY AND PRECISION

# pulling profits out of thin air

Due to conditions that are fast catching up with us, all business enterprise is having to seek out profits where profits didn't exist before! This isn't easy, but it has to be accomplished if business is to continue to operate and support our working population on the profit system.

The success of repetitive manufacture is based on the *design*, *manufacture*, and *use* of production tooling. This applies from the biggest, massive presses that force metal sheet into bath tub and auto body shapes, to the instrument makers' screw machines; from mass production of millions of identical pieces or products, to the smaller-scale but highly skilled contract manufacture of special machines and tools. The furthering of the *design*, *manufacture* and *use* of production tooling is the foundation or premise upon which TOOL & DIE JOURNAL's editorial coverage, circulation and readership have been built.

Only by the constant working and reworking of the *design*, *manufacture* and *use* of production tooling can heretofore non-existent profits be discovered. "Retooling" the bath tub from foundry to deep drawing press was one step. Next, logically, is using materials or combinations of materials that will give bath tubs such eye-value as to lessen subsequent expensive finish coating and baking operations. The end result is a more profitable production of bath tubs, lower prices, more bath tubs, and more and larger presses producing bath tubs; all due to more men, machines and tooling being "hired" by profits that didn't exist before.

A relay housing can be simplified and made more profitably by retooling. Each economy effected by each additional stage in its progressive die pays toward the additional toolmaker-hours in its retooling and the larger press that may be required.

Inserts in die castings and plastics permit one piece to do the work of two or more. Another step or flange "tooled" into a screw machine piece-part may eliminate later assembly and fastening. More intricate tooling, newer and larger machines may be necessary, but they, as well as lower selling prices, can be offset by production profits that didn't exist before.

Ours is a high production economy. We must think in terms of millions of pieces, parts, packages and people. The higher our production sights, the lower will be the unit economies that are imperative; i.e., .732c here, .283c there, .367c elsewhere, plus another .591c amount to less than the proverbial two cents, but when multiplied by a half-million press strokes there appears nearly $10,000.00 that didn't exist before!

Despite current reports of profitable operations, increasing material and labor costs have steered manufacturing profits, in too many other instances, toward the vanishing point. Coupled with increasing sales competition and the snow-balling resistance of the buyers' dollars, this means that the only still attainable profits are those that remain to be pulled virtually out of thin air by production brains, machines and tooling.

E. Willard Pennington

editor

# Shop Talk On Quality Control

by A. W. Ehlers
*Contributing Editor*

Many adequate textbooks have been written on the subject of quality control, some of which are: "An Engineer's Manual of Statistical Methods" by Leslie E. Simon, "Sampling Inspection Tables" by H. F. Dodge and H. G. Romig, and "Management of Inspection and Quality Control" by J. M. Juran.

Also, many monographs and technical publications, such as the Bell System Technical Publications, "Economic Quality Control of Manufactured Product" by W. A. Shewart, show specific applications and results of Quality Control.

References to the Binomial Theorem expansion and the Poisson Distribution Curves are necessary tools to the advancing science of Quality Control Theory.

However, all the textbooks, monographs, probability equations and distribution curves are not necessary to put Quality Control into active operation in the average production shop if the basic, everyday principles of Quality Control are explained to the shop management and to the shop men. For it is the shop man who actually makes Quality Control work. Without the shop's clear understanding of the program, even the best organized Quality Control programs are usually destined to either failure or ineffective application.

The writer certainly does not presume to be an authority on the subject of Quality Control or to lay claim to the title of statistical mathematician. However, he does feel that a plainly written discussion of the subject in everyday language will assist those readers who do not have the time nor opportunity for profound and detailed study of the subject in grasping enough of the basic principles to put the theory into actual practice.

Quality Control is based upon the science of statistical mathematics, which has been proved in many branches of scientific endeavor, business and the everyday life of the individual whether he lives in Oshkosh or Omaha.

Anyone who purchases life insurance, fire insurance, etc., pays premiums based upon the same statistical mathematics that supports the theory of Quality Control. The insurance companies record and chart the actual deaths per 100,000 unit of the population. They ascertain the causes of death, age limits, etc., and from this data set up probability equations to the effect that you, John Doe, will probably live to a ripe three score and ten plus. And if you suddenly cease paying premiums via a seventy-mile per hour skid on a slippery road, they pay off in full to your estate. But rest assured that the premiums charged to the rest of us careful drivers, based upon their mortality tables and probability curves, are sufficient to keep the insurance companies solvent and their stockholders happy.

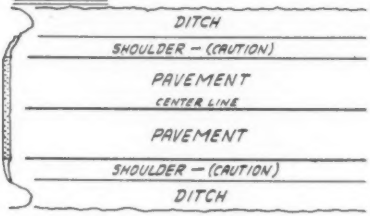
The seasoned Saturday night lodge brothers soon recognize that it is easier to fill in a color flush than it is to run up an inside straight. Intuition or hard experience may have indicated this fact to them, but a simple statistical equation would also have proved without a shadow of a doubt that their hunch was correct. The dice thrower or "crap shooter" will readily agree that the odds are better for winning at this game of chance and combination than other forms of "perpetual insolvency" such as Faro, Roulette, etc.

All of these references to probability, businesslike or otherwise, are based upon a simple definition or theorem, i.e., "The

probability or chance of an event is the ratio of the favorable cases to the total number of possible cases."

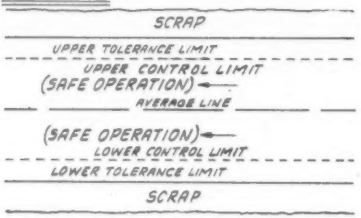
This definition or theorem simply means this: If a die or "dice" is thrown, it is reasonable to expect that one of the six faces of the die will turn up. If we wish to find out the possibility of throwing an "ace" with the die, we proceed to reason as follows: The total number of possible cases means that we can throw an "ace", "deuce", "trey", four, five or six. In other words, there are six possible cases, and the number of favorable cases of throwing the ace is just one. Therefore, the number of unfavorable cases is six minus one, or five. This resolves itself into the simple equation:

FIGURE 1

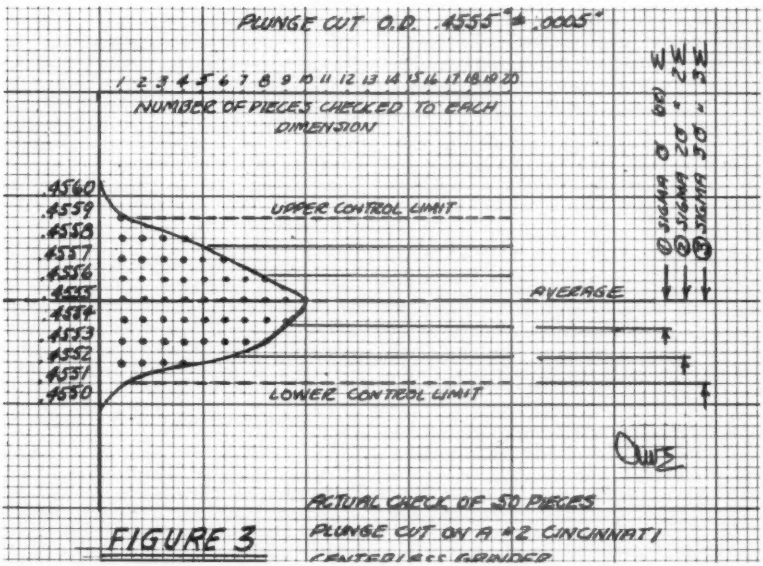



CONCRETE ROADWAY

FIGURE 2




SIMPLIFIED QUALITY CONTROL CHART




ACTUAL CHECK OF 50 PIECES
PLUNGE CUT ON A #2 CINCINNATI
CENTERLESS GRINDER

FIGURE 3

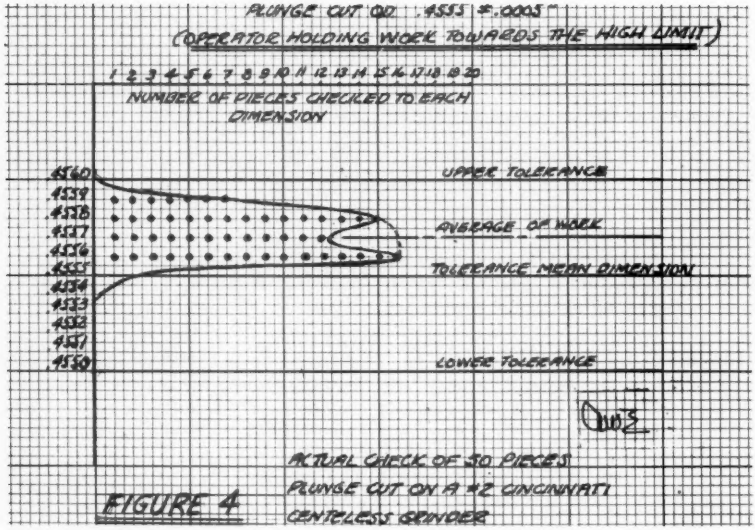



FIGURE 4

$$\text{Probability, or P,} = \frac{a}{a+b} = \frac{1}{1+5} \text{ or } \frac{1}{6}$$

where a = number of favorable cases, and b = number of unfavorable cases.

Therefore, the odds of throwing an "ace" on the first throw of the die are one to six.

Another everyday example is the probability (P) or odds of drawing an ace on the first draw from a standard deck of playing cards, which may be expressed as:

$$\text{P (Prob.)} = \frac{a}{a+b} = \frac{4}{4+48} = \frac{4}{52} = \frac{1}{13}$$

here, "a" in equaling the number of favorable cases means the four aces in the deck; and "b" equaling the number of unfavorable cases means the total number of cards in the deck (52) minus the four aces, or 48.

Therefore, the odds of drawing an ace upon the first draw from a standard deck are one to thirteen.

The expansion of the Binomial Theorem in statistical mathematics and the theory of statistical Quality Control have a fearsome sound. However, the fellows who play "odd man wins" with a "green-horn" third party know the practical basis of taking the sucker's money; with predetermined baiting "wins" and the inevitable combinations of "heads or tails". The contract bridge player soon realizes that the probability of getting a hand of thirteen spades is as remote as the moon due to the terrific odds against the combination involved.

Regarding the average reader who remembers ever so dimly his high school mathematics, the term $(a+b)^n$ can drive him back to his old textbook for an academic explanation of the expansion, but a practical problem for the card players will suffice for this article.

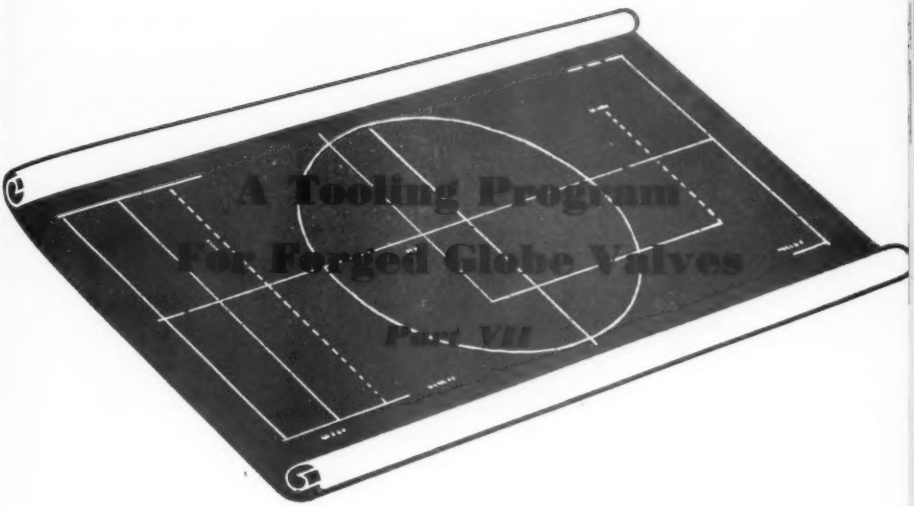
How many different five-card poker hands are there in a standard deck of 52 cards? To answer this, another simple equation presents itself:

$$C = \frac{N(N-1)(N-2)(N-3)(N-R+1)^*}{R!}$$

This looks involved, but by substituting:

C = Number of five-card combinations that are possible.

(CONTINUED ON PAGE 136)



# A Tooling Program For Forged Globe Valves

## Part VII

### Slide Bushing

The functions performed by the slide bushing component, E, Figure 24, of the Parker brass offset globe valve, are such that extreme precision is required in its machining. In the valve assembly, the slide bushing serves as a connector for holding the bonnet assembly and forged body together. This is accomplished by means of the external threads on the slide bushing engaging both the internal threads of the bonnet and the internal threads of the body. The slide bushing also serves as a guide in which the slide moves up and down as the valve is opened and closed. The slide is actuated up and down through the turning of the stem, that is, as the external Acme threads on the lower end of the stem mesh with the internal Acme threads of the slide, an up and down motion is imparted to the slide depending on the direction of rotation of the stem. If no means were provided to keep the slide from rotating when the stem is turned, the slide would rotate instead of moving up and down.

**by Carl F. Benner**
*Assistant Editor*

Therefore, the specifications call for the upper external end of the slide to be hexagonally shaped, F, Figure 24, and the inside of the slide bushing to be also hexagonally shaped, E, Figure 24, with a sliding fit allowance of from .010" to .020" provided by the dimensioning of these two parts. It can be seen that the hexagonal hole in the slide bushing must be accurately centered and be concentric with its external threads so that the slide will seat, as at K, Figure 24, when the valve is closed and the stem will not bind when it is turned.

In the second paragraph of Part III, page 72, TDJ, January 1947, the statement is made, "One of the requirements is that the drilled holes and internal threads of the body valve port be concentric with the center line, B, Figure 16." Reference to the body, A, seat, K, slide, F, and slide bushing, E, Figure 24, shows the importance of this concentricity requirement for both the body

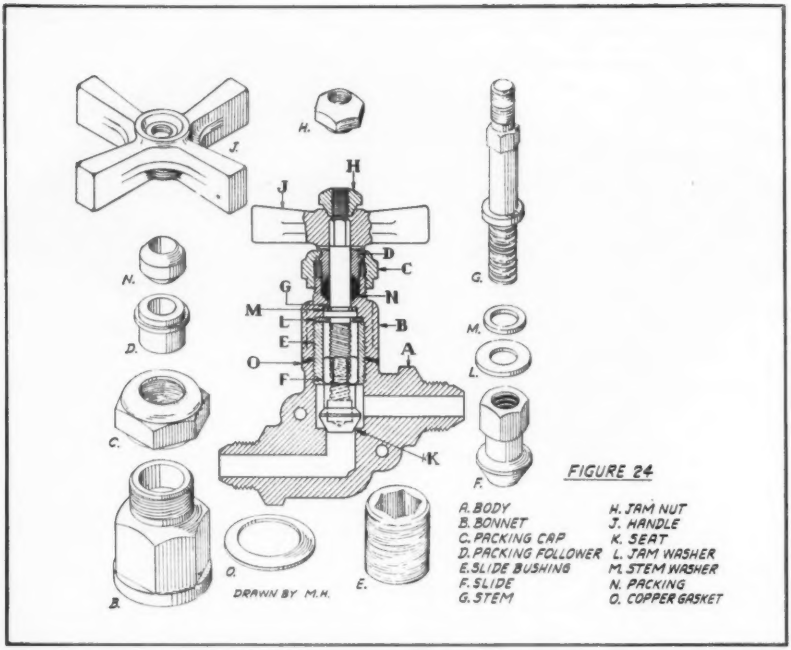



***Fig. 24. Cross-sectional view of a Parker Brass Offset Globe Valve. Machined, working parts of the valve other than the forged body are shown and identified for the respective tooling operations.***

and slide bushing. Because the vertically drilled, stepped hole, which forms the seat in the body, K, Figure 24, and the internal body threads of the valve port are concentric with the vertical centerline of the body, it is evident that the slide bushing (with external threads engaging the internal threads of the valve port) is accurately centered in the valve port. It therefore follows that the hexagonal hole in the slide bushing must be concentric with its external threads to insure accurate seating of the slide when the valve is closed.

### First Operation: Turning

The machining operations to complete the slide bushing are: turning the 15/16" round bar stock to the major diameter of a ⅞"—24-thread; drilling a hole through the piece preparatory to broaching; broaching; threading; counterboring; and chamfering. This cycle of machining operations appears to be simple for any four- or six-spindle automatic machine, except for the consideration of concentricity. All the required operations, except the broaching, could be run with one setup on an automatic and the broaching done as a second operation. However, the problem of concentricity presents itself, and the time and difficulty that would result in working from the pitch diameter of the threads to establish concentricity with the internal hexagonal, offset the addition of a third operation.

Therefore, the first cycle of operations produces a blank, rough turned, drilled through, chamfered, and reamed, but not threaded. This blank is run on a 1½" 4-spindle Conomatic. A description of the 4-spindle Conomatic was given in

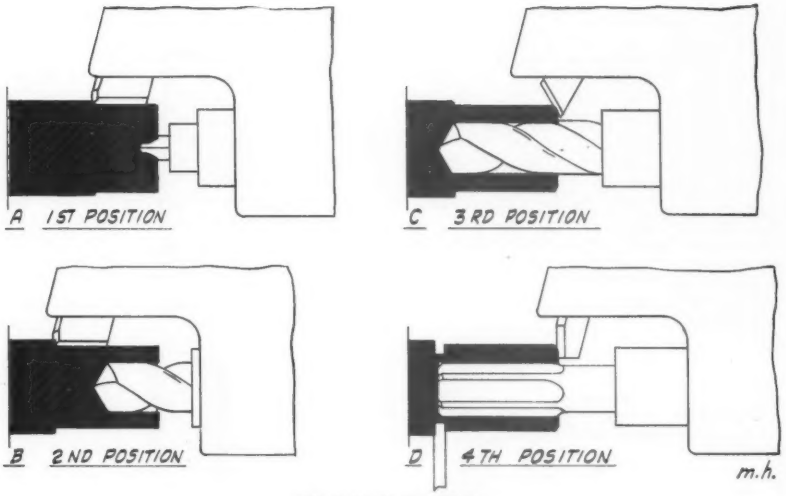



FIGURE 38

*Fig. 38. Tooling setups for machining the slide bushing blank on the 4-spindle Conomatic. The development of the shape of the blank by successive operations is shown in blue.*

Part VI of this series, TDJ, April 1947. The run is started by the bar stock being fed out to the stop in the fourth position, the collet automatically closes and locks, and the spindle carrier indexes to the first position. A center drill and turning tool bit are set up in a knee tool holder and mounted in the first position of the main tool-slide. The tool bit is set to reduce the diameter of the 15/16" stock (.9375") to .900" for a distance of 5/8" and the center drill starts a centering hole for the next drilling operation as shown at A, Figure 38. A 35/64" drill and a turning tool bit are set up in a knee tool holder and installed in the second position of the main tool-slide. As the spindle carrier indexes to the second position, the drill advances to drill a 35/64" hole 11/16" deep while the turning tool completes the .900" diameter cut for the full length of the part shown at B, Figure 38. In the third position of the main tool-slide a knee tool holder is set up with a 35/64" drill and chamfering tool. When the spindle carrier has indexed to the third position, the third position main tool-slide advances to complete drilling the 35/64" (.5468") hole through the part and to cut a .820"

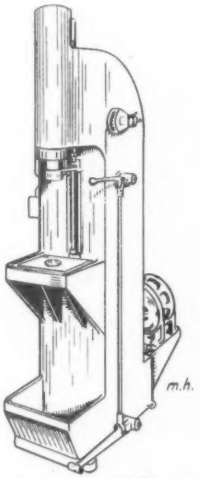



FIGURE 39

*Fig. 39. Hydraulic, push type, vertical broaching machine. Open area under table enables operator to retrieve the broach after the "push through."*

diameter, 30° chamfer on the end as shown at C, Figure 38. In the fourth main tool-slide position a knee tool holder carries a facing tool and a .562" diameter reamer, and the fourth position cross-slide carries a cutoff tool. When the

*Fig. 40 (below). Broaching adapter for the bushing broaching operation. It is positioned by inserting the smaller diameter into the hole in the machine table shown in Fig. 39. Fig. 41 (right). Broach shown forming a hexagonal hole inside the slide bushing.*

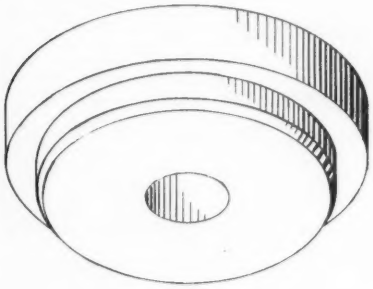


FIGURE 40

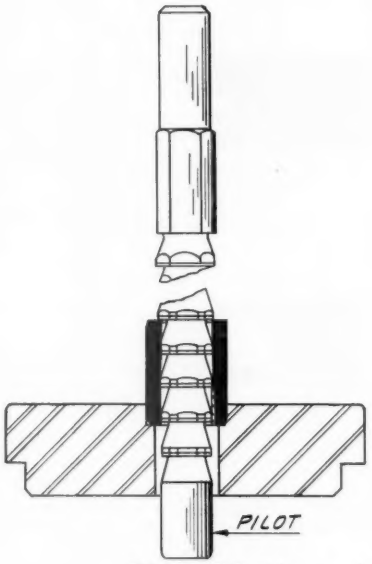



FIGURE 41 m.h.

spindle carrier completes indexing to the fourth position, the tools in the fourth position main tool-slide advance for reaming the drilled hole to .562" diameter and facing the end. This leaves .032" of material for final facing to dimension by a subsequent operation. As these tools are retracted, the fourth position cross-slide moves into the work with the cutoff tool and cuts off the blank shown at D, Figure 38.

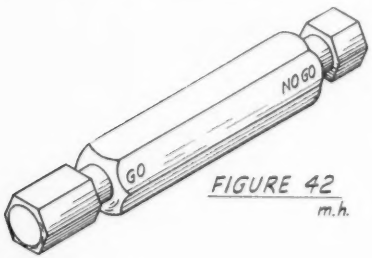



FIGURE 42 m.h.

*Fig. 42. Go and No-Go hexagonal plug gage used in gaging the inside hexagonal hole of the slide bushing to its specified tolerance of .005".*

**Second Operation: Broaching**

Broaching is a second operation performed on the slide bushing blank. A hydraulic, push type, vertical broaching machine, Figure 39, is used, which in its operation simply pushes the broaching tool through the workpiece, but does not retract it to the starting position, because the broach is not fastened to the ram. Therefore, as the broaching tool is pushed on through the work, the operator catches it below the broaching machine table. A broaching adapter, Figure 40, is set up on the table of the broaching machine and positioned by the protruding portion of the adapter which is inserted in the hole of the broaching machine table. The broach, Figure 41, has a total of sixteen teeth, ten of which make roughing cuts and six are for sizing, or finishing, the hexagonal hole to

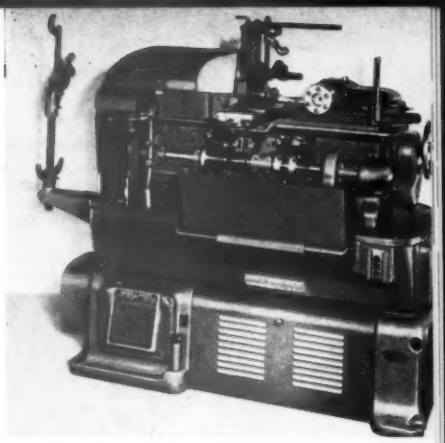


*Fig. 43. Front view of the 2G Brown & Sharpe single, reversible spindle automatic screw machine.*

the specified dimensions across the flats; whereas cutting across the corners of the hexagonal hole, thirteen of the teeth perform roughing cut and three do the final sizing or finishing. To align the broach in the work, a pilot, a few thousandths smaller in diameter than the reamed hole in the part is ground on the small end of the broach.

To perform the broaching operation on the slide bushing, E, Figure 24, the operator inserts the pilot of the broach in the drilled hole of the bushing blank, sets the bushing in the counterbored hole in the top surface of the broaching adapter (with the large end of the broach under the ram) and starts the machine. This results in the ram moving downward and pushing the broach through the reamed hole in the workpiece to form the specified hexagonal hole.

As the broach passes on through the workpiece, the operator retrieves it from the underside of the broaching machine table and repeats the operation on the next piece. Figure 41 shows the hexagonal hole taking shape during the broaching operation. All broached pieces are gaged with a Go & No Go hexagonal plug gage having .005" tolerance between the lower and upper limits, Figure 42.

**Third Operation: Turning and Threading**

The third set of machining operations is performed on a No. 2G Brown & Sharpe Automatic Screw Machine, shown in Figure 43. This machine has a positive drive to the single, reversible spindle by roller chains at all speeds. Spindle speeds, varying from 3025 to 25 rpm in 196 two-speed combinations, with 14 ratios of high to low speed from 1.6:1 to 13:1, and 48 rates of production, from three seconds to four minutes per cycle of operation, are a few of the features of this machine assuring maximum production efficiency on a wide variety of materials and range of work diameters. Automatic movements, such as indexing of the turret and feeding of the stock, are uniformly rapid for all rates of production and spindle speed. The swinging

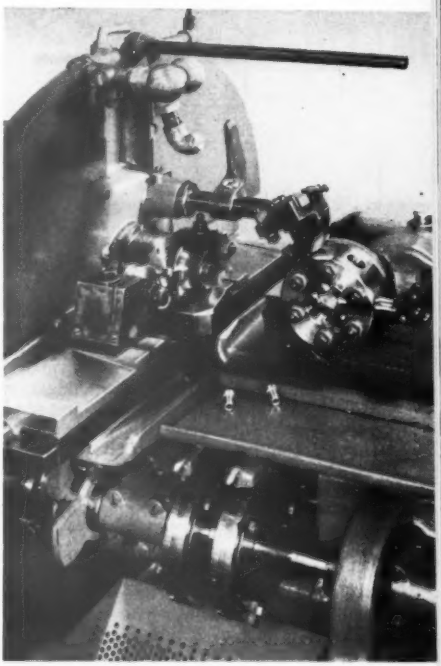
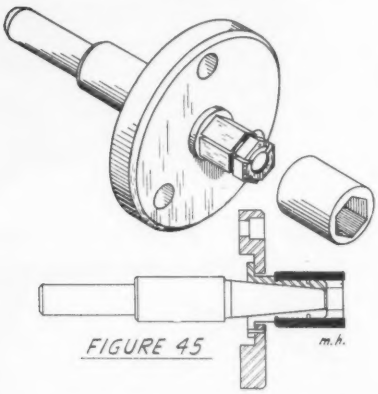


*Fig. 44. Front view of the turret working area of the 2G Brown & Sharpe automatic screw machine. The six-position turret is actuated and indexed by a lead cam, but the independent front and rear cross-slides are moved into the work by individual cams. The swinging stock stop operates in conjunction with the feeding mechanism, leaving all six turret holes available for operating tools.*

*Fig. 45. Adapter developed by Parker Engineers to hold the slide bushing while external turning, counterboring, chamfering and threading operations are performed. The slide bushing, mounted on the adapter, is shown in blue.*




stock stop, separate from the turret, operates in conjunction with the feeding mechanism, requiring no extra time and leaving all six turret holes available for operating tools. Double indexing of the turret is another important time saver; for jobs requiring only three turret tools, one set of tools can be used (in alternate holes) and two positions indexed in the same time required for single indexing. Figure 44 shows the six-position turret which revolves in a vertical plane on the side of the turret slide. The turret is withdrawn at the start of indexing and returned to the working position on completion of indexing, independent of action of lead cam. The turret is locked in position after indexing by an automatically-operated hardened tapered pin.

Two independent cross-slides, front and rear, Figure 44, are mounted in scraped ways cast integral with the machine bed. The feed of each cross-slide is controlled by an individual cam mounted on camshaft at front of the machine. Positive location of cams assures correct timing.

The machining operations performed on the slide bushing by the No. 2G Brown & Sharpe are: turning OD to .875"; counterbore and faceoff; thread; and chamfer. The previous machining operations performed have produced a workpiece 1⅛" long with a .900" OD, a .562" hexagonal hole through the center, and one end chamfered 30° on a .820" diameter. The remaining operations are performed externally, therefore the workpiece has to be held in the machine collet by some internal means. An adapter, Figure 45, consisting of three parts was developed by Parker Engineers for this operation. A mandrel with a shank turned on one end and the other end tapered to a 10° included angle; a holding plate; and a hexagonal expansion collet with a 10° tapered hole, make up the complete adapter. Three cuts 1/16" wide made longitudinally of the collet in conjunction with its tapered hole and the tapered mandrel provide an expanding grip which will securely hold the slide bushing for machining when it is slipped over the hexagonal collet.

In utilizing this adapter, its shank is inserted in the spindle collet of the No. 2G Brown & Sharpe and since the adapter must run true and remain fixed in the spindle for the duration of the run an indicator gage is used in making the setup.

A graphic picture of the cycle of operations performed on the slide bushing at this point is given in Figure 46, which shows the shape of the lead cam which actuates the turret slide. As the cam indicates, loading is the beginning

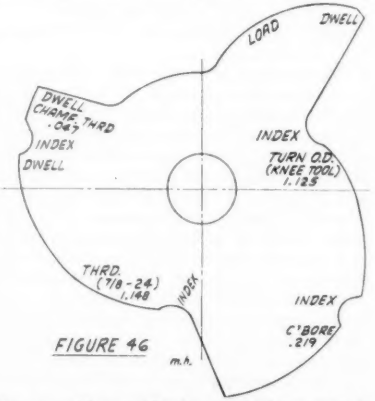



*Fig. 46. Shape of lead cam which actuates the turret slide in performing the external machining operations on the valve slide bushing.*

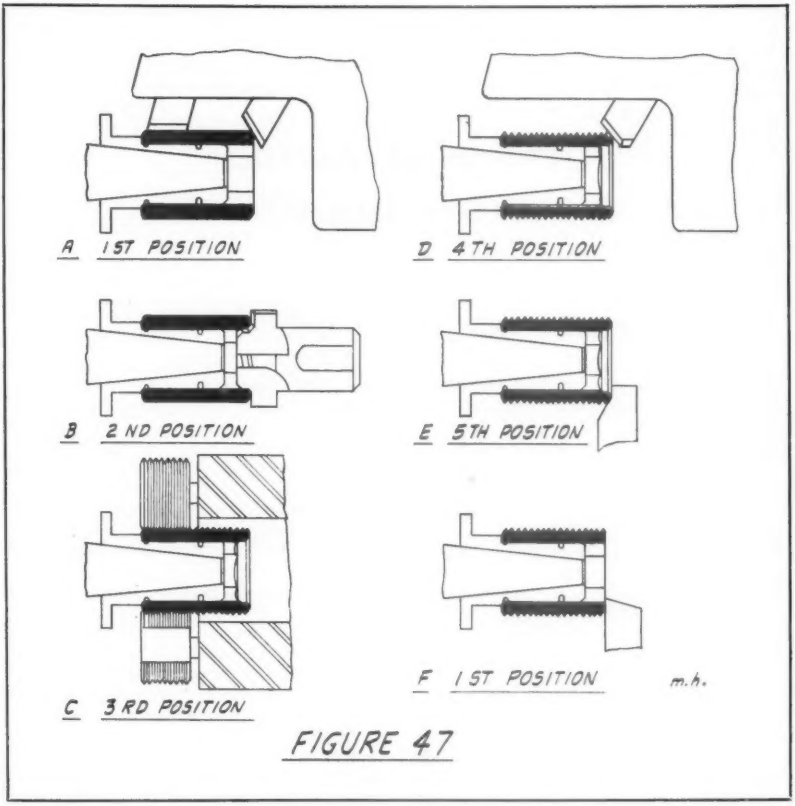



FIGURE 47

*Fig. 47. Tooling setups on the 2G Brown & Sharpe to complete the third set of machining operations on the slide bushing. The shape of the workpiece after each operation is indicated in blue.*

of the cycle. The operator loads a slide bushing on the adapter (cutoff end out), at the position of the cycle where there is no tool in the turret. As the turret indexes to the first position, a carbide turning bit and a chamfering tool are set up in a knee tool holder and mounted in the turret, move in to make a turning cut and chamfer the end, shown at A, Figure 47. This chamfering assists the starting of the threading die used in the third operation. After indexing, the turret moves in with a counterbore mounted in the second position, which counterbores the inside hexagonal shape to form an internal seat and faces off the outer end of the bushing, as at B, Figure 47. A self-opening die carried in the third position of the turret, C, Figure 47, moves in after indexing to cut a $\frac{7}{8}$"—24-thread the entire length of the bushing. Following the indexing of the turret to the fourth position, a chamfering tool set up in the fourth position comes in to chamfer the threads, D, Figure 47. Specifications require a 30° chamfer to a .820" diameter on both ends of the

*(CONTINUED ON PAGE 92)*

# Deep Drawing Aluminum*

The unusual definition of deep drawing is the production of a drawn shape whose depth is appreciably greater than its diameter, such as a cup shape 20 inches deep and 10 inches in diameter.

Many aluminum alloys can be deep drawn easily because of their excellent workability, it being equal to that of copper, brass and deep drawing steels. While single-action mechanical presses are satisfactory for drawing small parts, double-action mechanical or hydraulic presses are preferred for deep drawing work because of the much better control of blank-holding pressures which they permit. The precise setting of the vital hold-down pressure is easily attained by adjusting the outer ram. In addition, modern hydraulic double-action presses have speed controls which permit still more satisfactory control of the drawing operation.

Selection of press equipment is further determined by drawing pressures. One method of calculating drawing pressures for hydraulic presses assumes that they are approximately equal to the blanking pressures. These are determined in a number of ways. Actual shear load can be calculated from the cross section area of the part and shear stress of the metal. For mechanical presses, the shear load is multiplied by a factor (2-2.5) to obtain drawing pressure.

For example, assume a cup 6 inches in diameter, 5 inches high, 0.064 inch wall is to be drawn in 3S-O. The 18.85 inch circumference takes 6.635 or 7 tons shearing pressure for the ram on a hydraulic press.

For a mechanical press, use of the factor of 2.5 gives 16.5 tons required on inner ram. Blank-holding pressure is usually figured at one-third draw pressure.

This estimation of pressure does not include extra pressures required for ironing or to overcome wall friction. And for certain irregular shaped parts, pressure up to 50 percent more may be required.

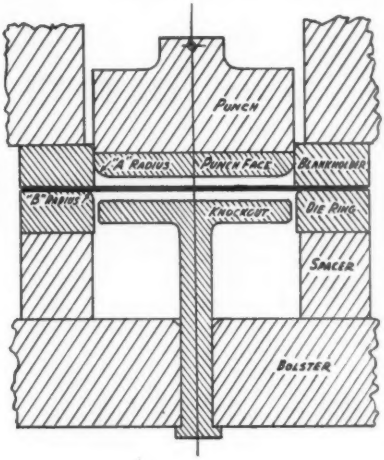
Design of deep drawn parts should be aimed at eliminating all frills, embosses, offsets, ridges, beads, etc., not absolutely necessary. Anything other than a smooth uninterrupted surface adds to the cost.

Now to calculate number of draw operations the starting blank size must be known. Since actual surface area of a blank changes little during drawing, blank size can be calculated by figuring the area of the drawn part. A common error is to compute blank area from lineal dimensions of the finished part instead of area of the finished part. At the same time, a safe allowance should be made to overcome loss of metal through possible "earing" and to provide sufficient metal for trimming. This allowance should be determined from the number of draws.

The number of drawing stages or reductions for aluminum stock ⅛ inch or thicker equals the blank diameter divided by diameter of the finished part. For material under ⅛ inch thickness, add another operation. In either case, if the result comes out .5 or larger fraction,

*Courtesy, Reynolds Metals Company "Technical Advisor"

*Fig. 1. Typical tooling design and construction for first operation draw. The assumption that the blank-holding pressure is usually one-third of the draw pressure does not include any extra pressures that may be required for "ironing" or to overcome wall friction.*




an extra operation must be figured.

Amount of reduction per draw for material ⅛ inch and thicker is calculated in this manner: Diameter after first draw equals blank diameter times 0.55-0.58; each subsequent draw is then 0.72-0.85 times previous draw diameter. For material under ⅛ inch, diameter after first draw is 0.58-0.60 of blank diameter; after subsequent draws, it is 0.78-0.85 times previous draw diameter.

It is always good practice to establish first and intermediate draws at even fractional sizes wherever possible. This promotes using tooling to the best advantage. Here is an example:

Assume we have the cup first mentioned, 20 inches deep inside, 10 inches inside diameter, beaded around top edge, and 0.064 inch thick. Total area is 773 square inches, giving a blank 31⅜ inches in diameter, with no allowance for earing and trimming.

Ratio of blank to finished part diameter is slightly over 3 to 1. Being under ⅛ inch thickness, we add one, giving four draw operations. Recommended allowance for earing and trimming is obtained by multiplying the cross sectional area of the finished shell by ¼ by the number of operations; in this case 10.064 x 3.1416 x ¼ x 4 or 31.6 inches.

Added to the 773 previously, we have 804.6 square inches, giving a blank 32 inches in diameter. Stages now become: First draw 32 x 0.58 or 18.56, say 18¾ inches; second draw 18¾ x 0.78 or 14.6, say 14¾ inches; third draw 14¾ x 0.80 or 11.8, say 12 inches; fourth draw 12 x 0.83 or 9.96, say 10 inches.

From the final draw, it will be necessary to flatten the top flange and sharpen the bottom radius in a subsequent operation. Trimming and beading complete the job.

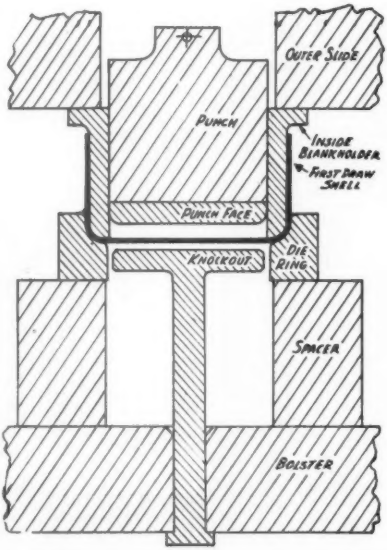



*Fig. 2. Typical tooling design and construction for second and subsequent draws, each reducing the cup diameter and increasing its depth. To promote designing and using tooling to the best advantage, it is always good practice to establish first and intermediate draws at even-fraction sizes wherever possible.*

## A BUYING GUIDE FOR ABRASIVES

**POINT No. 5**

# PRODUCT APPLICATION

Supplying abrasives of highest quality is but one way in which The Carborundum Company serves industry. Considered equally important by many users is the attention directed to correct use of these products. For this purpose The Carborundum Company has established a special group of product application engineers.

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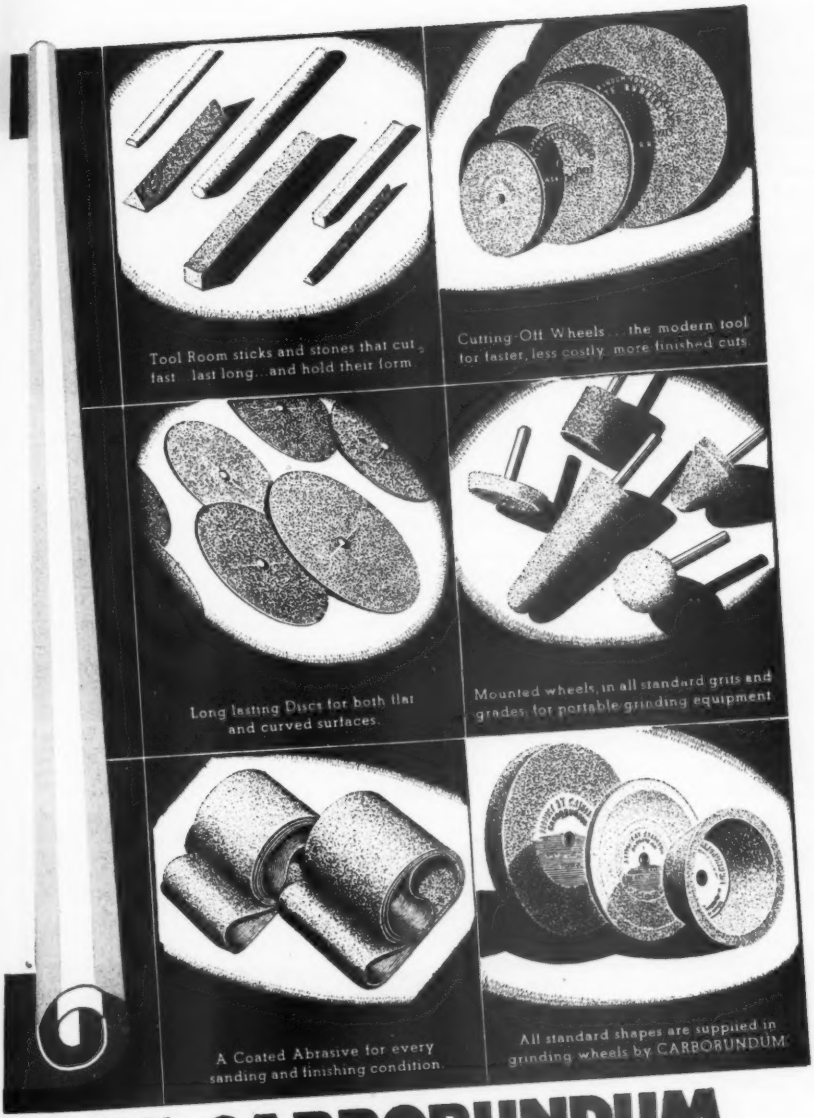
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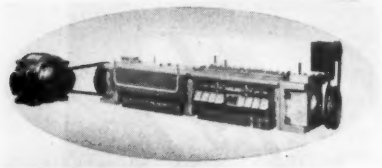
# Production Welding In One Operation

The new Ultra-Speed welder control unit permits automatic assembly welding rates up to 900 spots per minute. Designed to meet the increased demand for fully automatic multiple-spot resistance welding machines capable of producing a large number of joints quickly and in one operation, this new machine control has reduced practical production limitations of such machines to time required



to load and unload parts. In the design are incorporated numerous exclusive new features to assure dependability, accuracy, smooth operation, long life and a minimum of maintenance.

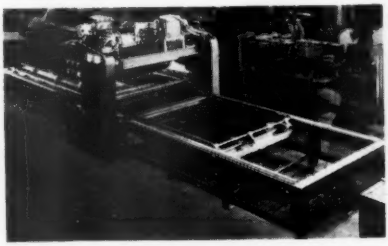
The Progressive Ultra-Speed unit, the heart of all Progressive Ultra-Speed welding machines, is shown above. It dispatches individually timed welding current to 10 to 100 or more guns, each adjusted to its own proper welding pressure. Welding rates up to 900 spots per minute speed the assembly of complicated parts in a single setup.

Ultra-Speed controlled machines can be built to accommodate an almost unlimited range of weld spacings and locations such as are required by automotive, refrigerator, stove, etc., sub-assemblies. Welding guns can be arranged in single or multiple rows, circles, steps, curves, etc., closely spaced or spanning full width of large panels. Reinforcing sections, brackets, spacers and trim forms can be joined to a main panel using the most suitable type and thickness of metal for each.

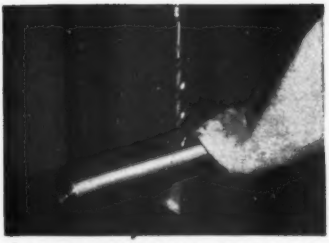
Integral clamping positions at the proper locations in the machines, plus the positive clamping action of welding guns applying pressure on the work simultaneously, results in a finish-forming action that automatically compensates for variations in the component parts.

Unit construction of the Progressive Ultra-Speed control permits combination of such units to accommodate as many welding guns as required for various assemblies. Lower photo shows Progressive Welder Company's typical Ultra-Speed machine welding panels of various lengths. The integral loading and clamping fixture mounted on horizontal carriage is moved into the machine by hydraulic motor at high speed, and automatically slows down and stops at first welding position within a tolerance of 10/1000". The guns come down and forty series welds are produced in the 16-gage steel. The guns raise while the carriage moves to the next weld position and the Ultra-Speed control unit returns to start position. The cycle is repeated until the required number of double rows of welds have completed the assembly. The carriage moves through the machine to unload the assembly at the rear. Total time for welding of each group of forty welds is only 15 seconds. One or more welding transformers can be used in connection with Ultra-Speed units as required to weld heavy sections, make single or multiple series welds or even projection welds at one operation. Contact blocks prevent transfer of cable kick to contacts.

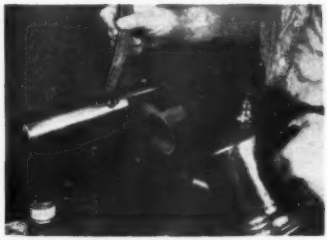
For complete story on this unit, write to Progressive Welder Company, Dept. 1-46, 3050 E. Outer Drive, Detroit 12, Mich., or use our postage-free INFORM-A-GRAM Key No. 146-X.



# 3 SIMPLE STEPS TO *Better* SQUARE HOLES IN BORING BARS, CUTTER HEADS, TOOL HOLDERS *with* STURDY SQUARE HOLED SLEEVES!



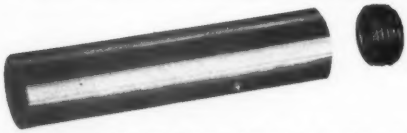
**1** Drill and ream the hole in the part to size. Sturdy Square Holed Sleeves are furnished to the size shown in the specification table or they may be ordered with .015" grinding stock so that you can grind your Sleeve to fit.



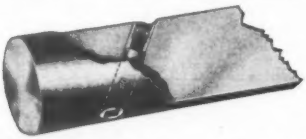
**2** Sweat or press Sleeve into place. If the Sleeve is longer than the diameter of the bar, the Sleeve should be set flush with the OD of the bar at the threaded end and the excess at other end ground off.

**3** Drill and tap for set-screw. This set-screw is not furnished with the Sturdy Square Holed Sleeve although the back-up screw is furnished.

**OVER 30,000 IN USE**



**One of the most difficult problems in tool making can be solved easily and quickly with Sturdy Square Holed Sleeves. The perfection of broached square holes can be had in boring bars, milling cutters and many other applications at a small fraction of the cost of imperfect hand-made square holes. The Sturdy Square Holed Sleeve consists of a round sleeve with a perfectly square hole broached through the center. This hole is tapped at one end to receive a back-up screw which is furnished with the Sleeve. The Sleeve can be sweated or pressed into a drilled and reamed hole to make a perfectly square accurate hole in a very few minutes.**



**The Sturdy Square Holed Sleeve will save you many hours and many dollars in the making of boring bars, milling cutters and other tools requiring square holes.**

*A tool holder made with Sturdy Square Holed Sleeves. Tool holders of all types can be made more quickly and at lower cost this way.*

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(Patents Pending)

## STURDY BROACHING SERVICE

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*Write for Literature*

## A Tooling Program

*(CONTINUED FROM PAGE 85)*

bushing. Therefore, a form tool is set up on the front cross-slide which is advanced by a form cam to make the chamfering cut on the seat end of the bushing, E, Figure 47.

To complete the machining on the slide bushing a new setup is made to finish face its other end which was chamfered to 30° on an .820" diameter by the Conomatic. In the new setup the same hexagonal shaped adapter is retained in the collet of the No. 2G Brown & Sharpe on which to reverse the slide bushing. A form cam actuates the front cross-slide carrying the facing tool as shown at F, Figure 47. This operation reduces the bushing to the required length of 1-1/16".

*(TO BE CONTINUED)*


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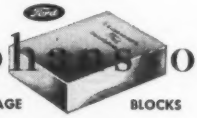

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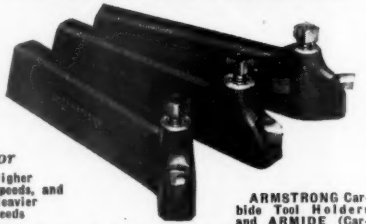
# ARMSTRONG *Carbide* TOOL HOLDERS



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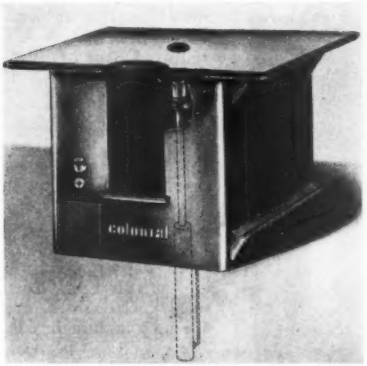
*Dahlstrom* TAP GUIDE

## "Flat-Tops" Support Broaching Work

One of the most unusual lines of broaching machines yet to make an appearance are the Colonial "Flat-Top" Utility pull-down broaching machines, best described as vertical "horizontal" machines. By making the platen horizontal, large bulky parts can be slid onto the table and manually positioned without other support. Setting up for and broaching of one or more holes and keyways in such parts becomes a simple matter.




The broach is pulled through the work by an hydraulic pull-mechanism operating on the same principle as in Colonial Universal Horizontal machines. After the part is placed on the flat-top table and manually positioned, the broach is inserted in the hole to engage the broach puller. The machine is started and the broach pulled down through the work. The machine stops, and the part is moved aside. The machine then returns the broach to loading position, permitting its removal. Cut-away illustration shows broach puller and top of pulling mechanism.

Information may be obtained from Colonial Broach Company, Detroit 13, Mich., or use INFORM-A-GRAM Key No. 26-X.

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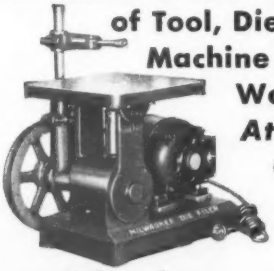
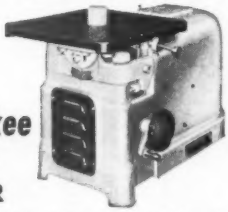


The Milwaukee DIE FILER

is designed primarily for straight-line, sharp-corner filing, sawing and lapping in the softer metals preparatory to hardening. It is used extensively in the making of tools, dies, jigs and fixtures. It is highly efficient, sturdily constructed, has few moving parts. Adjustments are extremely simple. Saw overarm is quickly attached.

The Milwaukee PROFILE GRINDER



permits a high degree of precision in grinding interior and exterior profiles having curved, odd and irregular surfaces. It is especially adapted to the precision finishing of hardened steel parts. Spindle revolves at 20,000 R.P.M., reciprocates vertically 100 times per minute. Takes grinding wheels from ⅛" to 1½" in diameter. Write For Illustrated Bulletins.

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## World Need of Machines

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Stressing the importance of machine tools, Wilkie adds, "Since present manufacturing facilities are inadequate to meet this unprecedented demand, much goods-producing machinery is needed; to make it, great numbers of machine tools—the machines that make other machines—are required first of all."

In addition to its world-wide known metal-cutting bandsaws, band-filing machines, surface grinders and precision inspection instruments, new products such as lathes, profilers, jig saws, radius shaping and milling machines, hand screw machines, etc., are now included.

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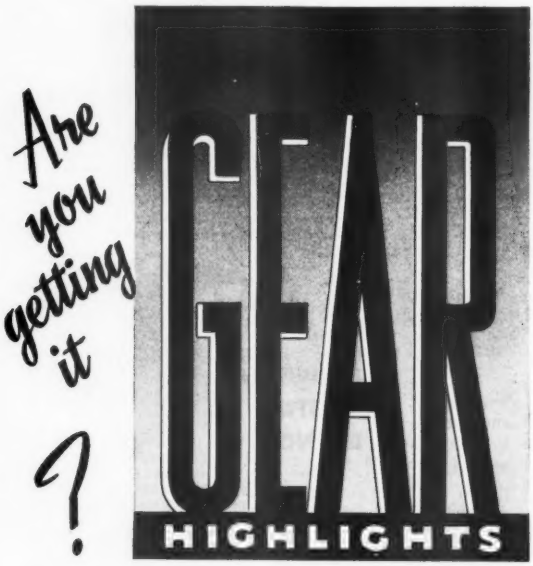


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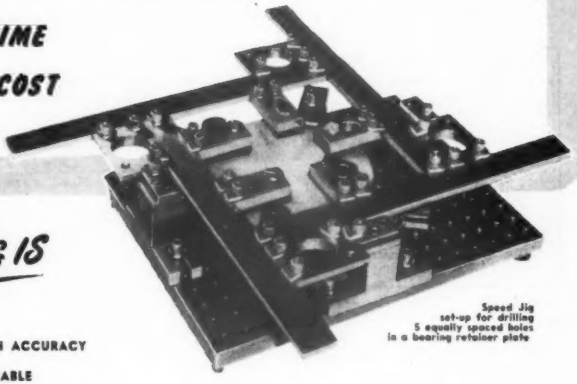

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# TDJ SHOP DATA SHEET NO. 60

## Calculating Optimum Number of Carbide Milling Cutter Teeth*

**The rate of metal removal is directly related to the horsepower available; therefore, in designing or selecting a milling cutter, the first considerations should be given to the speeds, feeds, and number of teeth in the cutter which will fully utilize the power in the machine without continuous overload.**

***Example:*** **Assume it is required to face mill a cut $\frac{3}{16}$" deep over a surface 4¼" wide by 10" long, on a steel forging having a Brinell hardness of 250. The machine to be used has a 10-hp motor to drive the spindle.**

*Known and Assumed Factors.*
(Letters in parentheses are symbols used in the following formulas)

| | | |
|---|---|---|
| 3/16" | (M) | = Depth of face mill cut. |
| 4¼" | (W) | = Width of surface cut. |
| 10" | (L) | = Length of surface cut. |
| 250 | (B) | = Brinell Hardness, Steel Forging. |
| 10 hp. | (hp) | = Available Motor Drive. |
| 0.6 | (K) | = Constant. Approximate cu. in. of steel that can be removed per hp per min. (based on dull cutters). |
| 80% | (P) | = Assumed hp delivered to milling machine spindle. |

*Cutter Size:* 6" (D) The 4¼" width of workpiece would allow for a 6" diameter cutter to be used.

*Feed:* .010" (F) Feed per tooth.
To produce the greatest number of pieces per grind, a feed of .006" to .012" per tooth is generally acceptable, therefore use .010" feed per tooth for estimating purposes.

*Speed:* 450 (sfpm). The best speed for milling operation is dependent upon the hardness of the workpiece. The accompanying table shows the recommended speeds for a wide range of work hardness.

| Brinell Hardness | Speeds in SFPM |
|---|---|
| 150 | 530-660 |
| 200 | 450-570 |
| 250 | 400-500 |
| 300 | 350-450 |
| 350 | 320-400 |
| 400 | 290-360 |

Thus for Brinell Hardness of 250 the table shows 450 sfpm would be suitable, but may be varied as future experience may warrant.

*Convert* sfpm to rpm

$$\text{rpm} = \frac{\text{sfpm}}{\text{cir. of cutter}}$$
$$= \frac{\text{sfpm}}{\pi D}$$
$$= \frac{450}{\pi/12 \times 6}$$
$$= \frac{450}{.262 \times 6}$$
$$= \frac{450}{1.572}$$
$$= 286.2\text{—Use } 310$$

Since exact speed given by this formula is probably not available on the machine, the next higher rpm should be used, unless the differential is too great. It is assumed that 310 rpm is available.

*No. of Teeth* (N)

$$N = \frac{K \times hp \times P}{M \times F \times rpm \times W}$$
$$= \frac{.6 \times 10 \times .80}{.1875 \times .010 \times 310 \times 4.25}$$
$$= \frac{4.8}{2.47}$$
$$= 1.9$$

Thus a 2-tooth cutter is best suited for this job.

*Table of Travel* (T)

$$T = F \times rpm \times N$$
$$= .010 \times 310 \times 2$$
$$= 6.2\text{" per min.}$$

The actual feed used is selected from the next lowest feed available on the machine. Assume that 5½" per min. table travel is available, then actual feed per tooth is,

$$F = \frac{T}{rpm \times N}$$
$$= \frac{5.5}{310 \times 2}$$
$$= \frac{5.5}{620}$$
$$= .009\text{"}$$

As a check to see that available horsepower is not exceeded, the working data should be substituted in the formula:

$$hp = \frac{N \times M \times F \times rpm \times W}{K \times P}$$
$$= \frac{2 \times .1875 \times .009 \times 310 \times 4.25}{.6 \times .80}$$
$$= \frac{4.45}{.48}$$

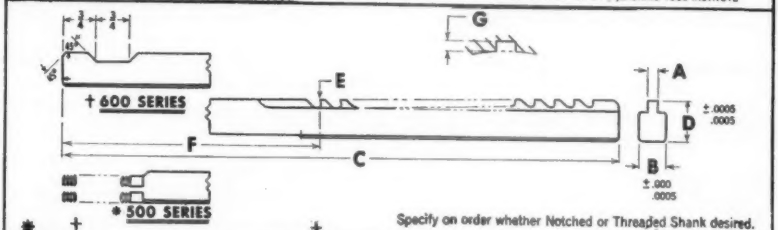
= 9.3 This is within the horsepower available and demonstrates the working data is suitable for this job.

*Courtesy Carl Le May, Test Engineer, Carboloy Company, Inc., Detroit, Mich.

# TDJ SHOP DATA SHEET NO. 61

## STANDARD KEYWAY CHART

STANDARDS ADOPTED BY BROACHING TOOL INSTITUTE




* † ‡ Specify on order whether Notched or Threaded Shank desired.

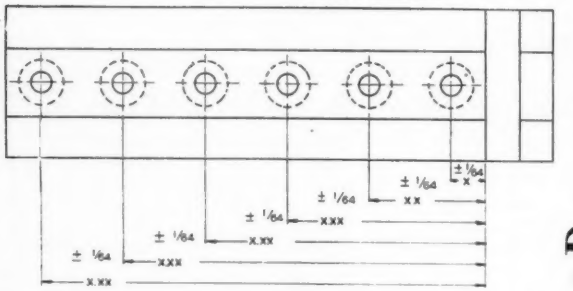
| 500 SERIES * | 600 SERIES † | A | | | MIN. HOLE SIZE | MIN. LENGTH CUT | MAX. LENGTH CUT | B | C | D | E | F | G | NO. OF CUTS | THREAD SIZE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | NOM. DIM. | DECIMAL DIM. | TOLERANCE | | | | | | | | | | | |
| 501 | 601 | 1/16 | .0635 | ±.0002 | 3/8 | 3/8 | 1 1/4 | .1552 | 20 | .313 | .271 | 7 13/16 | .042 | 1 | 1/4-20 |
| 502 | 602 | 3/32 | .0948 | ±.0002 | 7/16 | 1/2 | 1 1/2 | .1865 | 24 | .367 | .309 | 8 1/4 | .058 | 1 | 5/16-18 |
| 503 | 603 | 1/32 | .0948 | ±.0002 | 3/8 | 3/8 | 2 1/2 | .249 | 33 | .491 | .433 | 10 | .058 | 1 | 3/8-16 |
| 504 | 604 | 1/8 | .126 | ±.0002 | 1/2 | 1/2 | 1 1/2 | .249 | 30 | .438 | .364 | 9 | .074 | 1 | 3/8-16 |
| 505 | 605 | 1/8 | .126 | ±.0002 | 7/8 | 3/8 | 2 1/2 | .3115 | 36 | .594 | .520 | 10 | .074 | 1 | 1/2-13 |
| 506 | 606 | 5/32 | .1572 | ±.0002 | 19/32 | 1/2 | 1 1/2 | .249 | 30 | .525 | .436 | 9 | .089 | 1 | 3/8-16 |
| 507 | 607 | 5/32 | .1572 | ±.0002 | 23/32 | 3/8 | 2 1/2 | .3115 | 33 | .625 | .536 | 10 | .089 | 1 | 1/2-13 |
| 508 | 608 | 3/16 | .1885 | ±.0002 | 11/16 | 3/8 | 2 1/2 | .374 | 36 | .581 | .476 | 10 | .105 | 1 | 1/2-13 |
| 509 | 609 | 7/16 | .1885 | ±.0002 | 15/16 | 11/16 | 3 1/2 | .374 | 36 | .796 | .691 | 10 11/16 | .105 | 1 | 1/2-13 |
| 510 | 610 | 7/32 | .2198 | ±.0002 | 11/16 | 3/8 | 2 1/2 | .374 | 33 | .557 | .437 | 10 | .120 | 1 | 1/2-13 |
| 511 | 611 | 7/32 | .2198 | ±.0002 | 15/16 | 11/16 | 3 1/2 | .374 | 42 | .813 | .693 | 11 1/16 | .120 | 1 | 1/2-13 |
| 512 | 612 | 1/4 | .251 | ±.0002 | 11/16 | 3/8 | 2 1/2 | .374 | 36 | .612 | .476 | 10 | .136 | 1 | 5/8-13 |
| 513 | 613 | 1/4 | .251 | ±.0002 | 1 | 11/16 | 4 | .499 | 45 | .877 | .741 | 11 13/16 | .136 | 1 | 5/8-11 |
| 514 | 614 | 1/4 | .251 | ±.0002 | 1 1/16 | 7/8 | 6 | .624 | 51 | 1.250 | 1.114 | 13 1/2 | .136 | 1 | 3/4-10 |
| 515 | 615 | 5/32 | .2828 | ±.0002 | 7/8 | 11/16 | 4 | .499 | 42 | .716 | .564 | 11 3/8 | .152 | 1 | 3/4-11 |
| 516 | 616 | 5/32 | .2828 | ±.0002 | 1 1/16 | 7/8 | 6 | .499 | 51 | 1.093 | .941 | 13 1/2 | .152 | 1 | 7/8-11 |
| 517 | 617 | 1/16 | .314 | ±.0002 | 1 | 11/16 | 4 | .499 | 45 | .908 | .741 | 11 13/16 | .167 | 1 | 3/4-11 |
| 518 | 618 | 1/16 | .314 | ±.0002 | 1 1/16 | 7/8 | 6 | .499 | 51 | 1.158 | .991 | 13 1/2 | .167 | 1 | 7/8-11 |
| 519 | 619 | 3/8 | .3765 | ±.0002 | 1 1/16 | 11/16 | 4 | .499 | 45 | .938 | .739 | 11 13/16 | .199 | 1 | 7/8-11 |
| 520 | 620 | 3/8 | .3765 | ±.0002 | 1 1/16 | 7/8 | 6 | .499 | 54 | 1.189 | .990 | 13 1/2 | .199 | 1 | 7/8-11 |
| 521 | 621 | 7/16 | .439 | ±.0002 | 1 1/16 | 11/16 | 4 | .624 | 48 | 1.390 | 1.160 | 12 | .230 | 1 | 7/8-10 |
| 522 | 622 | 7/16 | .439 | ±.0002 | 2 | 1 | 8 | .624 | 48 | 1.611 | 1.496 | 15 3/8 | .230 | 2 | 1/4-10 |
| 523 | 623 | 1/2 | .5015 | ±.0002 | 1 1/2 | 11/16 | 4 | .624 | 48 | 1.312 | 1.051 | 12 | .261 | 1 | 3/4-10 |
| 524 | 624 | 1/2 | .5015 | ±.0002 | 1 1/2 | 1 | 8 | .624 | 48 | 1.377 | 1.246 | 16 1/2 | .261 | 2 | 3/4-10 |
| 525 | 625 | 9/16 | .5645 | ±.0003 | 1 3/4 | 11/16 | 4 | .6865 | 54 | 1.438 | 1.146 | 11 13/16 | .292 | 1 | 1 - 8 |
| 526 | 626 | 9/16 | .5645 | ±.0003 | 1 3/8 | 1 | 8 | .6865 | 51 | 1.391 | 1.245 | 16 | .292 | 2 | 1 - 8 |
| 527 | 627 | 9/16 | .5645 | ±.0003 | 2 1/4 | 1 1/8 | 12 | .874 | 60 | 1.641 | 1.495 | 20 | .292 | 2 | 1 - 8 |
| 528 | 628 | 5/8 | .627 | ±.0003 | 1 7/8 | 11/16 | 4 | .749 | 60 | 1.625 | 1.301 | 12 3/16 | .324 | 1 | 1 - 8 |
| 529 | 629 | 5/8 | .627 | ±.0003 | 2 1/2 | 1 | 8 | .874 | 54 | 1.657 | 1.495 | 16 3/8 | .324 | 2 | 1 - 8 |
| 530 | 630 | 5/8 | .627 | ±.0003 | 2 1/4 | 1 1/8 | 12 | .874 | 57 | 1.657 | 1.495 | 20 | .324 | 2 | 1 - 8 |
| 531 | 631 | 3/4 | .752 | ±.0003 | 1 7/8 | 11/16 | 4 | .874 | 60 | 1.625 | 1.239 | 12 3/16 | .386 | 1 | 1 - 8 |
| 532 | 632 | 3/4 | .752 | ±.0003 | 2 | 1 | 8 | .999 | 60 | 1.688 | 1.495 | 16 1/4 | .386 | 2 | 1 1/4 - 7 |
| 533 | 633 | 3/4 | .752 | ±.0003 | 2 1/4 | 1 1/8 | 12 | .999 | 57 | 1.688 | 1.560 | 20 | .386 | 3 | 1 1/4 - 7 |
| 534 | 634 | 7/8 | .877 | ±.0003 | 2 1/4 | 11/16 | 4 | 1.124 | 63 | 1.875 | 1.426 | 12 3/8 | .449 | 1 | 1 1/4 - 7 |
| 535 | 635 | 7/8 | .877 | ±.0003 | 2 1/4 | 1 | 8 | 1.124 | 63 | 1.719 | 1.494 | 15 3/4 | .449 | 2 | 1 1/4 - 7 |
| 536 | 636 | 7/8 | .877 | ±.0003 | 2 1/4 | 1 1/8 | 12 | 1.124 | 63 | 1.719 | 1.569 | 20 | .449 | 3 | 1 1/4 - 7 |
| 537 | 637 | 1 | 1.002 | ±.0003 | 2 1/4 | 3/8 | 2 1/2 | 1.249 | 63 | 1.750 | 1.239 | 10 1/2 | .511 | 1 | 1 1/2 - 6 |
| 538 | 638 | 1 | 1.002 | ±.0003 | 2 1/4 | 7/8 | 6 | 1.249 | 63 | 1.750 | 1.494 | 14 1/4 | .511 | 2 | 1 1/2 - 6 |
| 539 | 639 | 1 | 1.002 | ±.0003 | 2 1/4 | 1 1/8 | 12 | 1.249 | 60 | 1.750 | 1.580 | 20 | .511 | 3 | 1 1/2 - 6 |

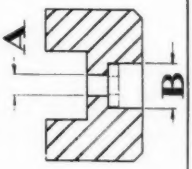
* Designates Thread Type Shank. † Designates Notched Type Shank.
‡ Minimum length of part recommended to prevent part from dropping in between teeth of broach.

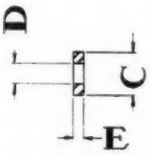
# TDJ SHOP DATA SHEET NO. 62

## SPECIFICATIONS AND METHOD OF DIMENSIONING SCREW HOLES AND WASHERS FOR BROACH INSERTS AND HOLDERS

### BROACH HOLDERS



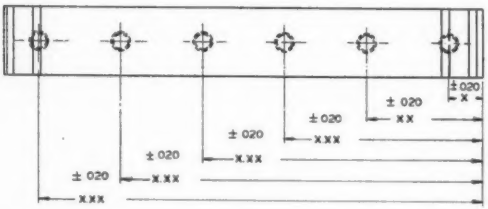



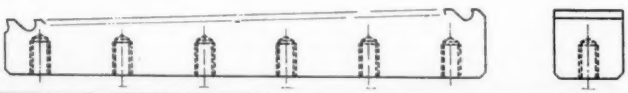




WASHER

| SIZE OF SCREW | #8 | #10 | 1/4 | 5/16 | 3/8 | 7/16 | 1/2 | 9/16 | 5/8 | 3/4 |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 17/64 | 19/64 | 23/64 | 27/64 | 31/64 | 35/64 | 39/64 | 43/64 | 47/64 | 55/64 |
| B | 17/32 | 19/32 | 23/32 | 25/32 | 29/32 | 1 1/32 | 1 5/32 | 1 9/32 | 1 13/32 | 1 19/32 |
| C | 7/16 | 1/2 | 5/8 | 11/16 | 13/16 | 15/16 | 1 1/16 | 1 3/16 | 1 5/16 | 1 1/2 |
| D | 13/64 | 7/32 | 9/32 | 11/32 | 13/32 | 15/32 | 17/32 | 19/32 | 21/32 | 23/32 |
| E | 1/16 | 1/8 | 1/8 | 1/8 | 3/16 | 3/16 | 3/16 | 3/16 | 1/4 | 1/4 |

### BROACH INSERTS



STANDARDS ADOPTED BY BROACHING TOOL INSTITUTE FEBRUARY, 1947 PRINTED IN U. S. A.

# INDUSTRIAL DIGEST

★

**Science • Research • Methods • Tooling • Production • Trade News and Reports**

## "Precision Hole Location" Gets '46 Citation

"Precision Hole Location", by J. Robert Moore, the 448-page book on interchangeability in toolmaking and production recently published by the Moore Special Tool Company, Inc., of Bridgeport, Conn., has been selected among the Fifty Books of the Year 1946 by the American Institute of the Graphic Arts, it was announced at the opening of the Twenty-Fifth Anniversary Exhibition on March 11.

The fifty books were selected "to honor, by selection and exhibition, the work of those designers, manufacturers and publishers who, in the opinion of the jury, have solved most successfully their artistic and technical problems and to demonstrate through travelling exhibitions what are the principles of good bookmaking."

The Moore Company, manufacturers of the Moore Jig Borer and Moore Jig Grinder, is the only manufacturer among the Fifty Books winners listed as a publisher.

"Precision Hole Location" is a comprehensive review of all hole location practices and their evolution to the point where the toolmaker can now employ engineered methods and apply the principle of interchangeability to his own operation. It has been widely acclaimed in the metal-working industry since it was published at the end of 1946.

## Broaching Tool Survey Develops Standards

The Broaching Tool Institute has completed an extensive survey among its members regarding the use of broaching equipment which has resulted in the adoption of standards on a method of dimensioning screw holes and washers for broach inserts and holders and in the adoption of a standard keyway chart. The purpose of such standards is to provide tool engineers with a uniform set of specifications with which each of the broaching equipment manufacturers is familiar so that interchangeability of tooling will be possible.

The primary consideration in developing the standard for screw holes was to permit the best possible heat treatment without the restriction of controlling location of holes due to growth. A broad tolerance is, therefore, allowed on center distance of holes in broach inserts as well as in broach holders. To accommodate this variation of center distances, the holes in the holders are made sufficiently large and washers are used to compensate for the difference.

Benefits which will result in the use of this standard are that it will permit some adjustment in all directions for salvaging inserts when worn and it will insure interchangeability of inserts in holders which are made independently of the inserts.

These two standards are reprinted on pages 101 and 102 of this issue of TOOL & DIE JOURNAL. Extra copies of these standards may be obtained from Broaching Tool Institute, Dept. 48, 74 Trinity Place, New York 6, N. Y.

## Industrial Research Expansion Foreseen

Expansion of research by industry and an immediate shortage of trained personnel for industrial and scientific research were foreseen by Dr. A. B. Kinzel, chairman of the Board of the Engineering Foundation, in the Foundation's recent 32nd Annual Report.

The shortage of research personnel will be relieved, Dr. Kinzel predicted, as more students undertake graduate work in universities which at present are inadequately staffed because of competition for trained men by Government and industry. Industry has steadily become more research minded and, consequently, large expansions of industrial research are ahead, both for individual companies and associations of various types.

The Engineering Foundation sponsored sixteen projects during the past year, including soil mechanics; fluid mechanics; materials of engineering comprising such researches as alloys of iron, stability of steels as affected by temperature, plastic flow of metals, and strength of metals; welding; lubrication; and rolling friction. In the current report, grants were recommended for the continuation of nine projects and the support of four new ones.

"Hydraulics of Manifolds", a research project at the University of Iowa, is directed towards a clarification of the basic principles governing flow in manifolds. Related research has gone on at Ohio State University to devise instruments for measuring the flow of liquids and gases when the flow is not uniform but pulsating. The Engineering Foundation helped foster research for material used in an important reference book on fluid dynamics, as applied to turbines and compressors, compiled by Dr. John R. Weske, Professor of Aerodynamics at Purdue University. Alloys of Iron Research was re-established last year after a period of inactivity during the war, and the first of a series of books concerning the advances in ferrous metallurgy made during the war is now being prepared.

Special supplementary research includes an attempt to determine what happens to metals in rolling and drawing, processes widely employed in industry; effects of high pressures on the viscosity of lubricants; energy losses due to rolling resistance in certain typical cases; problems in the design, fabrication and performance of welded structures.

Copies of the Engineering Foundation report are available from The Engineering Foundation, 29 West 39th St., New York 18.

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## The Third Step

In January, before the National Conference of Business Paper Editors, Washington, D. C., Brigadier General Donald Armstrong, Assistant to the Chairman of the Executive Committee of the American Standards Association, spoke confidently of how this country has passed from the first step, termed the primary stage or agricultural economy, through the second step or technological stage devoted to the machinery of production, to finally the vital Third Step. The Third Step, which means an economy without waste motion, material or power, is producing the fruits of the machine so they move almost automatically into the hands of the consuming citizen.

A few things seem salient in any such forward-looking examination of our industrial future: (1) making a greater volume of goods than ever produced before, (2) production on an efficiency and cost basis incomparably higher than the general level prevalent today, (3) a wage system enabling the producing worker to consume part of his output and that of other workers, and (4) a free government permitting consumer and worker to enjoy this flood of goods.

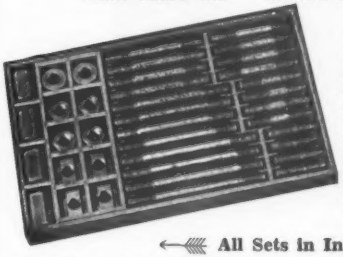
Machinery for one aspect of this desirable result already exists, and General Armstrong explained how the ASA, a federation of 98 technical, trade, governmental and consumer bodies, and about 2,000 company members, functions to see that the best industrial practice in any given field becomes, as soon as practicable, the accepted practice in that field. The ASA office in New York, with a staff of 90 engineers, technicians and others, helps industrial, governmental and consumer bodies carry this work forward.

Two successive Secretaries of Commerce, Messrs. Henry A. Wallace and W. Averill Harriman, have designated the ASA as the proper clearing house through which private enterprise may carry on this drive toward greater industrial efficiency, and to see that this aspect of increased industrial efficiency goes forward in the national interest.


*Handy*

**SET-UP STUD AND NUT SET**

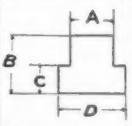
EVERY MACHINE IN YOUR PLANT NEEDS ONE ★ QUICKLY PAYS FOR ITSELF IN TIME SAVINGS



Each Set Consists of
4—3" Studs
4—5" Studs
4—7" Studs
4—Nuts
4—"T"-Slot Nuts
4—4" Studs
4—6" Studs
4—8" Studs
4—Washers
4—Coupling Nuts

All Sets in Individual Cases

**Specially designed T-slot nut will prevent damage to table slots caused by ordinary nuts.**




| Holes & Thread | A | B | C | D |
|---|---|---|---|---|
| ½"—13 THD. | .555 | ¾" | 11/32" | ⅝" |
| ⅝"—11 THD. | .675 | 1⅛" | 13/32" | 1⅛" |
| ¾"—10 THD. | .800 | 1⅜" | ⅝" | 1⅜" |

Prices
½" Set, $22.00
⅝" Set, $24.00
¾" Set, $28.00

Made of Quality Steel, Case Hardened and Chrome-Plated for Long Life.
Class 3 Threads
Sets Sized to Provide Greater Rigidity in Clamping.
*IMMEDIATE DELIVERY*

NOBLE & STANTON, INC.
*Manufacturers of Tools, Gages and Their Accessories*
1002 BROADWAY • BEDFORD, OHIO
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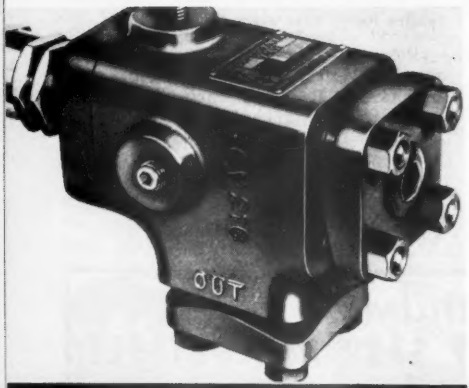
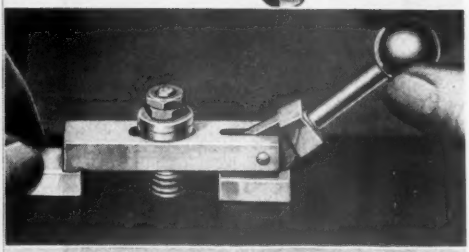
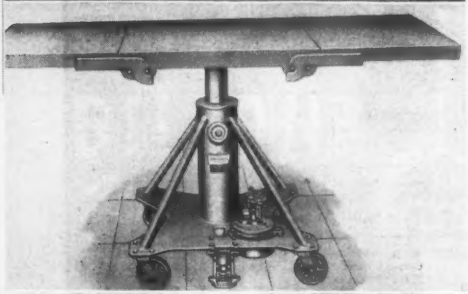
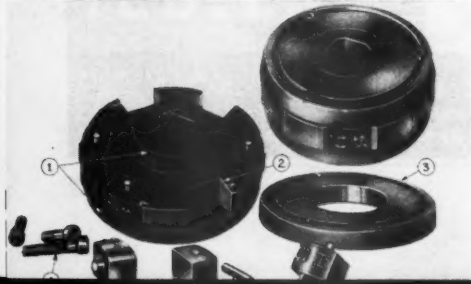
# PROGRESS

NEW DEVELOPMENTS • IMPROVEMENTS • COST AND TIME SAVERS








**FOR FURTHER INFORMATION FILL IN KEY NUMBERS ON POSTAGE-FREE INFORM-A-GRAM INSERT**

**INCORPORATING MANY NEW FEATURES,** the new 5000 psi relief valve manufactured by the Superdraulic Corp. completely eliminates squealing and chatter. Affording instantaneous action to prevent objectionable pressure peaks, this valve insures high efficiency and long life through perfect hydraulic balance. Other advantages of this trouble-free unit will be further explained upon request by THE SUPERDRAULIC CORP., Dept. 82, Dearborn, Mich., or use INFORM-A-GRAM Key No. H82-X.

**CONSISTING OF 4 STYLES OF FIXTURE CLAMPS** of very small size, the "Midget" series produced by West Point Mfg. Co. facilitates easier holding of very small workpieces. The clamp strap is only 2½" x 5/8" x 3/8", yet each clamp is made in exact proportion to the larger series, including the use of spherical washers with ground radii. Additional data is obtainable from WEST POINT MFG. CO., Dept. 67, 19625 Merriman Court, Farmington, Mich., or use INFORM-A-GRAM Key No. J67-X.

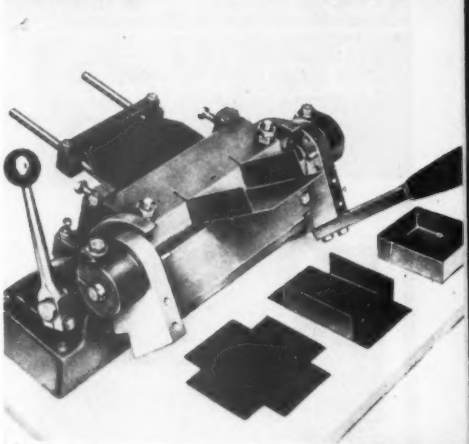
**DESIGNED TO ADAPT STRIP AND SHEET FOR PRESS FEEDING OPERATIONS,** the Lyon-Raymond Hydraulic Elevating Table, with easily handled and removable table top extensions, is now available. Firm support for up to 72 inches is rendered by the standard model; a modified table can be furnished for longer lengths. Additional material may be requested from LYON-RAYMOND CORP., Dept. 3-74, 3061 Madison St., Greene, N. Y., or use INFORM-A-GRAM Key No. 374-X.

**PROVIDING AN EFFICIENT AND ECONOMICAL METHOD OF MARKING STEEL TUBING,** the new style insert roll developed by the M. E. CUNNINGHAM CO. is made of Safety Mecco Alloy Steel in three parts to include (a) side ring and hub, (b) type insert ring, and (c) locking ring. A patented insert ring aids in proper spacing and eliminates "jumping". Write for more data to the manufacturer, Dept. 1-70, 104 E. Carson St., Pittsburgh, Pa., or use INFORM-A-GRAM Key No. 170-X.

# ON PARADE

**INSPECTING, SORTING, AND COUNTING SMALL PARTS** on the basis of .0001" tolerance, the Limitron, developed by the Arma Corp., permits a blind man to do a job which heretofore has employed the technique of a highly skilled person with excellent vision. The inspection system is an electronic light or tone indicating comparator with automatic classifications of parts to 1½" maximum size; is adaptable for both manual and hopper feeds; speeds up to 7,000 pieces per hour; and changes over from one part or dimension to another in a few minutes. Request additional information about this inspection device from ARMA CORP., Dept. 79, Brooklyn, N. Y., or use INFORM-A-GRAM Key No. K79-X.

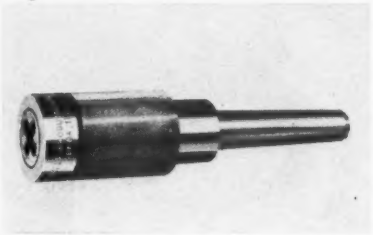
**COVERING THE ANGLE FORMING AND PLANE CHANGING STAGE** of the Di-Acro system of Die-Less Duplicating for accurately developing to definite outlines materials which have been blanked to shape with the Di-Acro Shear, the Di-Acro Brake makes quick work of forming containers, etc. Versatile, with a wide working range, it may be adjusted to handle varying size, weight, and style needs. Incorporated in this brake is "Rok-Lok" clamping action which grips material without marring, yet provides enough pressure to assure a sharp accurate bend. Get a 40-page booklet completely describing the Di-Acro System of Die-Less Duplicating from O'NEIL-IRWIN MFG. CO., 315 Eighth Avenue, Lake City, Minn., or use INFORM-A-GRAM Key No. 20-X.



**ELIMINATING THE NECESSITY OF MANUAL BROACH HANDLING** and simplifying the broaching of keyway slots in the bores of heavy-duty steering knuckles, the new Air-Operated Eccentric Fixture designed by the Colonial Broach Co. consists of a 10-ton Colonial utility hydraulic press equipped with their standard pull-down broaching attachment. Effort is reduced on the part of the operator because loading the part "over" the broach is not necessary with this outfit. Other details about this machine may be requested from COLONIAL BROACH CO., Dept. 26, Box 37, Harper Station, Detroit 13, Mich., or use INFORM-A-GRAM Key No. 26.5-X.

# PROGRESS ON PARADE

**ECONOMICALLY CUTTING EXTERNAL AND INTERNAL THREADS** on small production runs of lathe-turned parts, the new Falls Releasing Tap and Die Holder is designed for use in both screw machine and ordinary engine lathes, and is made in three standard shank sizes: No. 2 Morse Taper, ⅝" and ¾"



straight. Using the common 1" button type die for external threading or standard taps for tapping holes, this holder operates simply and involves low initial cost. Other features will be explained upon request by FALLS PRODUCTS, INC., Dept. 48, 128 Genoa St., Genoa, Ill., or use INFORM-A-GRAM Key No. K48.5-X.

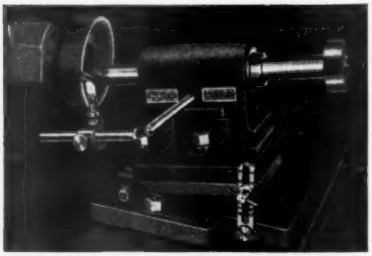
**INCREASING PRODUCTION RATES TWO AND A HALF TIMES OR MORE,** the "Red

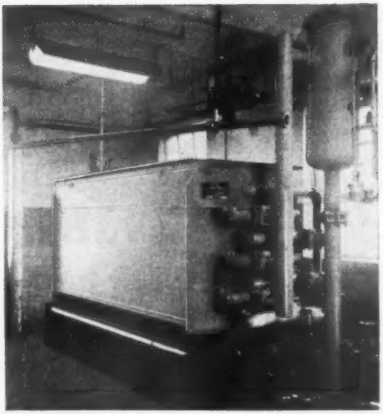
Ring" Model GCS Turmatic Gear Shaving Machine features two cutting stations and four work stations. The cutter heads are spaced 90 degrees apart and move the shaving cutters simultaneously into mesh with their respective work gears on adjacent turret faces. Fully automatic while the machine is properly loaded, the cutter heads back out of mesh and the turret indexes 180 degrees to present two fresh gears to the cutters. More details on this efficient machine may be obtained from NATIONAL BROACH & MACHINE CO., Dept. 39, 5600 St. Jean, Detroit, Mich., or use INFORM-A-GRAM Key No. A39-X.

**HANDLING ALMOST ANY KIND OF LOW TEMPERATURE METAL,** the new Forrester Alloy Sprayer, just announced by the K & F Metal Spray Industries, heats quickly and

melts metal in from 2 to 10 minutes. All electric, with a temperature control adjustable from 100 to 600° F, this unit features rapid push-button control, enabling metal ¼" thick to be deposited over a 4" x 6" area in less than a minute. A coating thin enough to permit the distinction of fingerprint lines, wood grain, and the dot pattern in half-tone engravings, is possible with this outfit. Request further material from K & F METAL SPRAY INDUSTRIES, Dept. 23, 11204 Charlevoix Ave., Detroit 14, Mich., or use INFORM-A-GRAM Key No. K88-X.

**GREATLY ENLARGING THE SCOPE OF USEFULNESS** of the Weldon End Mill Sharpening Fixture, the specially designed Weldon Sub-Base adjusts readily to a selected angle, enabling the sharpening of end teeth of any style end mill. Plainly stamped with the





# NIAGARA LIQUID COOLER Gives High Capacity in Small Space

Cold water, chilled to 33° F., or cold liquids, or non-freezing solutions below 32° F. are produced economically by the new Niagara Liquid Cooler.

For large capacity equipment it is most compact. For example, one model furnishes 92 G. P. M. of water cooled from 45° F. to 35° F., with 28° F. refrigerant, in less than 30 sq. ft. of floor space. Other models . . . 24 to 465 G. P. M.

Extra advantages: positive temperature control; assurance of holding temperature accurately in spite of variation in cooling load; rapid chilling of liquid; savings in power and refrigeration consumption.

*Write for Bulletin No. 100-TD.*

**NIAGARA BLOWER COMPANY**

*Over 30 Years of Service in Industrial Air Engineering*

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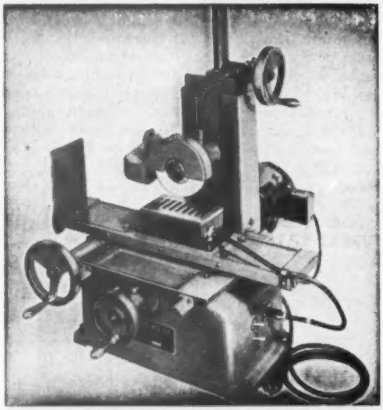
NIAGARA

AIR ENGINEERING EQUIPMENT

# SANFORD



## High-Speed BENCH SURFACE GRINDER

**ACCURATE WITHIN .0001**

A sensitive machine built to rigid standards of accuracy and workmanship specially designed *"For the job that fits in your palm."*

WRITE FOR BULLETIN

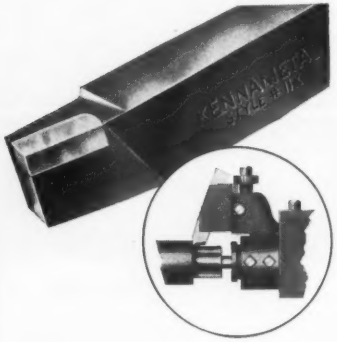
**SANFORD MFG. CO.**

**1020-28 Commerce St.**

**Union, N. J.**

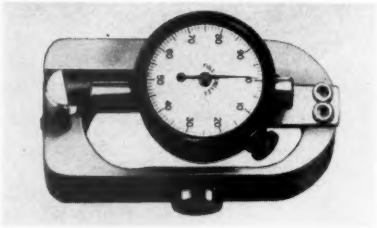
different degrees of angle, the Sub-Base assures simple and accurate operation. The Weldon Sharpening Fixture, comprised of base, rocking head, finger arm assembly, necessary wrenches, screw driver and screws, permits rapid sharpening with only one pass per tooth of all End Mills—fast, slow, right or left spiral—and requires no centers or lead cams. Its rocking head allows the End Mill to move away from the grinding wheel for the return stroke without change in machine table setting and without loosing guide finger contact. Advantageous to present users of the Weldon Sharpening Fixture, the Sub-Base is purchasable separately, or both outfits are available as a unit. Get more details and specifications from WELDON TOOL CO., Dept. 5-17, 3000 Woodhill Road, Cleveland, Ohio, or use INFORM-A-GRAM Key No. 517.5-X.

**FOR USE IN KNEE ATTACHMENTS OF TURRET LATHES,** a new line of Kennametal-tipped tool bits is available in a range of



Kennametal cemented compositions for machining steel, cast iron, and non-ferrous metals in three sizes and styles. Other information about the Knee-type Tool Bit may be requested from KENNAMETAL, INC., Dept. 33, Latrobe, Pa., or use INFORM-A-GRAM Key No. 33-X.

**SMALL ENOUGH TO FIT INTO TIGHT PLACES USUALLY INACCESSIBLE,** yet where pressures of static or moving parts must be measured, the new Dillon Mechanical Pressure Gage can be used to check pressures between spot welding machine electrodes, platens of all types of presses, and moving rollers; and the tension in a moving thread, twine, wire, etc. Compact and lightweight, this unit is extremely versatile, working in vises, between all types of clamps and even as a miniature testing machine. Unaffected



by extreme temperatures, it may be used indoors or out. More information will be supplied by W. C. DILLON & CO., INC., 5410-H W. Harrison St., Chicago 44, Ill., or use INFORM-A-GRAM Key No. A58-X.

**DEVELOPED TO DO THE FINEST TYPE OF WORK,** the new SIP Jig Borer, Type MP-2H, guarantees accuracy for all settings of its 27½" x 12½" table to .0015". The measuring

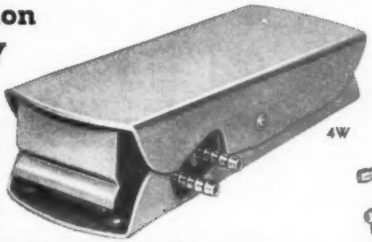
system includes two standard scales in the table slides, which are viewed by built-in micrometer microscopes reading to .0001". This entire system is enclosed and free from any mechanical strain. Get more information from THE COSA CORP., Dept. 2-50, Chrysler Building, New York, N. Y., or use INFORM-A-GRAM Key No. 250-X.

**BRINGING ALL THE ADVANTAGES OF HYDRAULIC PRESS OPERATION** within the range of arbor and kick press users who have not been able to afford a switch to this method, the new six-ton capacity Air-Hydraulic Press combines the speed of air

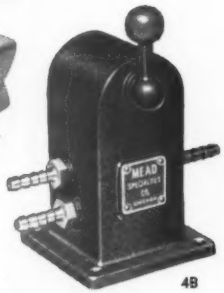
# READY.. *the New* MEAD

## Combination 3 or 4 Way

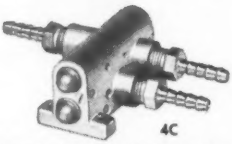
# AIR VALVE



4W




4B



4C

This new, ingenious MEAD VALVE is almost universal in its uses yet is so simply constructed it gives long, troublefree service. No sliding closures . . . 1/16" movement operates from full open to full closed helping speed of action, minimizing operational fatigue.

**4B BENCH VALVE** . . . for use on machine table or bench. Functions as a 4-way valve . . . two 3-way valves . . . one 3-way valve . . . and as a 3-way valve and a blower!

**4W FOOT CONTROL** . . . pedal works valve either as 3-or-4-way. Adjustable pedal stop provides quick change from 3-way to 4-way. Same combination of functions made by rocking pedal as by moving lever of bench valve.

**4C FOR CAM OPERATION** . . . can be mounted on drill press, etc., for automatic control of air cylinder by suitable cam.

Write for new Air Power Catalog describing Mead's Air Vises, Clamps, Presses, Workfeeders, Controls, etc. Just off the press!

**MEAD SPECIALTIES COMPANY • 4114 No. Knox Ave. • Dept. HA-57 Chicago 41, Ill.**



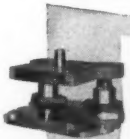
# NOW EVANS OFFERS YOU . . .

## *NEW SPEED and ACCURACY*

**WITH MICROLEX ANTI-FRICTION DIE SETS . . .**

Microlex Die Sets have ball or roller bearing guide pins which reduce die setter's time . . . enable you to get into production quicker . . . permit fast press speeds. Microlex Die Sets eliminate all down time caused by bound, scored or galled pins. Bearings have pre-load to prevent play between guide pins and bushings.

You don't have to wait to cash in on the profitable advantages offered by Microlex Die Sets. A large number of sizes are ready for immediate shipment.



MICROLEX

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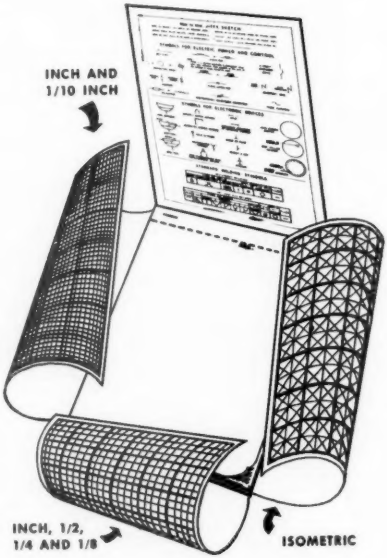
and smooth power of oil to eliminate racking noises, impact shock damage and operator fatigue. Quickly and easily adjustable, the ram pressure is precision controlled up

to 12,000 lbs. By delivering the same pressure throughout the entire length of stroke, operations usually requiring greater power are possible. Actual applications, specifications, and price list are in the illustrated 8-page catalog obtainable from AIR-HYDRAULICS, INC., Dept. TDJ, 401 Broadway, New York 13, N. Y., or use INFORM-A-GRAM Key No. J26-X.

**ADJUSTABLE BY THOUSANDTHS OF AN INCH** with a half-inch travel of screw, Central Certified Accuracy Inside Calipers are ideal for internal measurements. Measurement up to a full range is permitted with the addition of extension rods. A special set, No. 808, is now available complete with knurled extension handle and deluxe plush-lined leather

case. Range is 1½"—8". Controlled factory conditions, skilled workmanship, specially designed machines and super-sensitive equipment at Central Tool assure dependability. Data on Set No. 808 and other Central Micrometers is carefully given in Catalog No. 17 now available from THE CENTRAL TOOL CO., Dept. 85, Cranston 10, R. I., or use INFORM-A-GRAM Key No. K85-X.

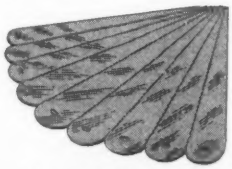
**PERMITTING THE MAKING OF PROPERLY PROPORTIONED DRAWINGS** without the use of a ruler, drafting board or T-Square, Jiffy Sketch Pad contains 75 sheets of tracing




paper enclosed within a jacket cover of four cardboard flaps, each imprinted with various drafting scales. To use the pad, the cover flap is folded back and a tissue sheet placed over the necessary scale: isometric, 1/10", ½", ¼", ⅛". The pad measures 9" x 12", and sheets are perforated for easy removal. Other information about the Jiffy Pad may be requested from JIFFY SALES CO., Dept. 87, 1815½ East 37th St., Cleveland 14, Ohio, or use INFORM-A-GRAM Key No. K87-X.

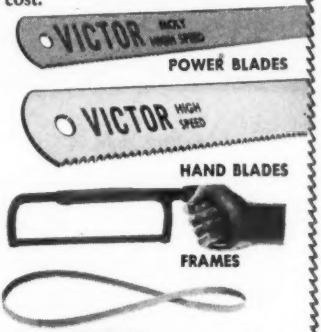
**ADAPTABLE FOR CONNECTIONS TO FLEXIBLE SHAFTS** of fractional-horsepower motors, new Speedo tools for filing, grinding, hammering, and similar operations in precision work are lightweight and handled with ease. The easily attached Speedo Filing

## wide blade selection



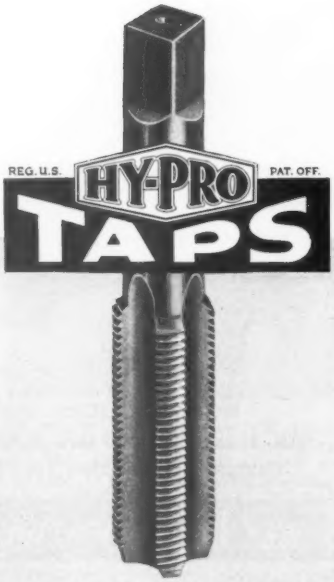
## makes light work

LIGHTEN the work by choosing the right blade for each job from your VICTOR supplier. He's got a full line of them—a VICTOR blade and frame for every job a hack saw or band saw can do. You can rely on VICTOR saws for the right kind of fast, clean cutting on metal, plastics, and other non-metallics, too... the kind that saves time and labor cost.




**VICTOR**

Victor Saw Works, Inc., Middletown, N.Y.
Makers of Hand and Power Hack Saw Blades, Frames and Metal Cutting Band Saw Blades




## *Accurate Tapping for Stronger Fastenings*

Tighter, vibration-defying, enduring fastenings result when thread tolerances are held to extremely close limits by accurate tapping.

HY-PRO Ground Thread Taps consistently produce accurate threads. Their extra hardness and durability result in longer life, more work between sharpenings... to cut costs and speed production.

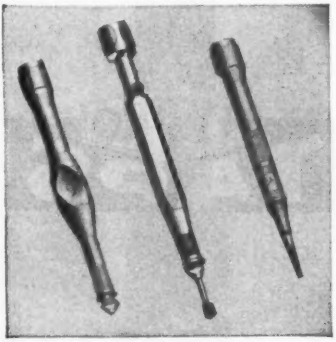
**PROMPT DELIVERY, Many special as well as standard taps in stock.**

**COMMERCIAL • PRECISION • SPECIAL GROUND THREAD TAPS**

*Send for Catalog on company letterhead*

**HY-PRO TOOL CO.**
New Bedford, Mass., U.S.A.

Handpiece is gear driven and delivers from 500 to 1500 strokes per min. at 1000 to 3000 rpm. Both the Speedo Hand Grinder and



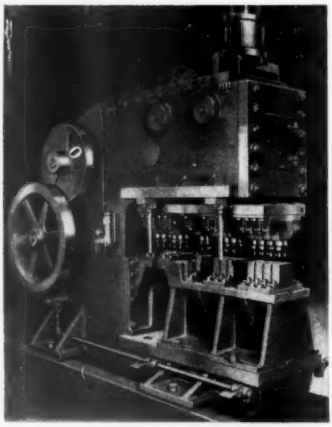
Hammer also have special features which make them versatile precision tools. Review these tools in the new Bulletin, T-47, which is now available from SPEEDO MANUFACTURING CO., INC., Dept. TDJ, 48 West 48th St., New York 19, N. Y., or use INFORM-A-GRAM Key No. K84-X.

**SOLID CARBIDE DRILLS,** manufactured by Willey's Carbide Tool Co., give exceptional efficiency and considerably lower production

costs in drilling cast iron, brass, bronze, magnesium alloys, aluminum and nonmetallic materials. Diameters range from 1/16" to ½", and lengths from 2½" to 6". Complete information is available from WILLEY'S CARBIDE TOOL CO., Dept. 5-51, 1340 W. Vernor Highway, Detroit 1, Mich., or use INFORM-A-GRAM Key No. 551-X.

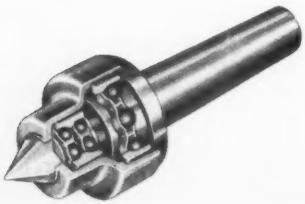
**INTRODUCING A SPECIAL REPLACEABLE ALLOY STEEL POINT** ground true with the bearings, the new live center manufactured by Sturdimatic Tool Co. also offers the other recognizable Sturdimatic features: low overhang, slight cushioning action to compensate for any expansion due to heat, and reduction of wear. Its large thrust bearing takes all of the thrust load, and radial bearing takes only radial load. Special data may be requested from STURDIMATIC TOOL CO., Dept. 4-78, 5216 Third Ave., Detroit 2, Mich., or use INFORM-A-GRAM Key No. 478-X.

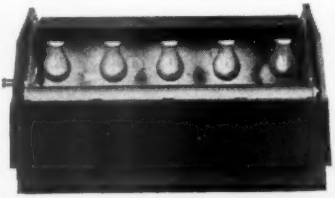
**DESIGNED TO ACCOMMODATE** a wide range of structural steel shapes and sections for both flange and web punching in one handling, the new size 12 Toggle Machine



developed by the Beatty Machine and Mfg. Co. features punching tools with double-gag punching and die holders to save time and eliminate re-handling. This small, fast machine will be explained further on request by the BEATTY MACHINE & MFG. CO., Dept. 49, Hammond, Ind., or use INFORM-A-GRAM Key No. H49-X.

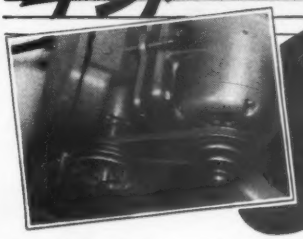
**TURNING OUT CRISP BLUE OR BLACK LINE PRINTS** in sizes up to 24" x 18" in less than three minutes, the Foster Photo Printer is designed to supplement the regular blue print equipment usually employed by large





# 4 Speed Drive

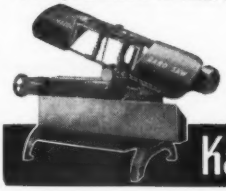
a Feature of the Kalamazoo Metal Cutting BAND SAW



You can cut tubes, solids, hard or soft materials on the Kalamazoo Metal Cutting Band Saw. Speed changes are quickly made by slipping belt from one position to another on the step pulley. Hinged motor mount tilts back for instant belt adjustment.

Four different speeds available — so practically every cut-off job in your plant can be handled accurately and fast — including many now being done on high priced equipment.

Ask your dealer or write direct for complete information.



**MACHINE TOOL DIVISION**
**KALAMAZOO TANK & SILO CO., Kalamazoo 16, Mich.**
**In Canada — BRIDGE MACHINERY CO., Montreal**

**Kalamazoo *Metal Cutting* Band Saw**

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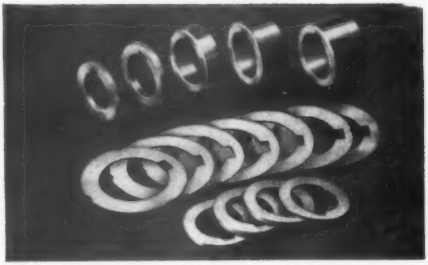

MACHINISTS HAVE LEARNED TO RELY ON DE-STA-CO Arbor Spacers and Shims for milling, slitting, gang-saw set-ups and for shimming gears and bearings. De-Sta-Co long-life steel Spacers are packaged in a standard range of sizes from ⅜″ to 4″ hole diameter, up to 5½″ outside, thicknesses from .001″ to .125″, all *with keyway.* Shims are stamped and coined to commercial tolerances in the same preferred sizes, *without keyway.*

Special spacers—thicknesses greater than .125″—are also available in popular sizes, machined from bar stock, hardened and ground, with standard keyways and thickness identifications.

Handy spacer kits of 19 graduated decimal thicknesses are stocked by Mill Supply Dealers in principal industrial centers. *Order your Packaged Precision Today.*

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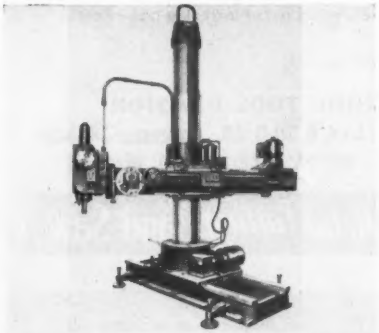
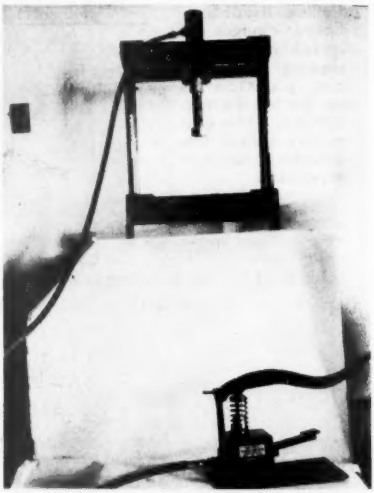
companies. Units scattered through a plant would permit prints to be secured in a few minutes. Handling prints from paper or cloth tracings, printed or typewritten sheets or handwritten copy, this machine is inexpensive to operate, uses photo-flood bulbs. There is a closed paper supply compartment in its base. For additional data write to FOSTER SALES CO., Dept. 98, 4200 Woodward Ave., Royal Oak, Mich., or use INFORM-A-GRAM Key No. K98-X.

**COMBINING ALL OPERATIONS OF THE CONVENTIONAL RADIAL DRILL** and a horizontal drilling and tapping machine into a single unit, the new 125 portable Universal Horizontal Drilling and Tapping Machine can



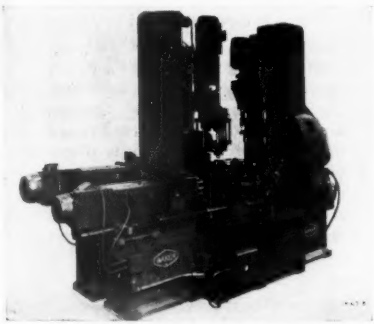
drill and tap at any conceivable angle in any plane within the maximum and minimum limits of travel or movement of the machine units. It eliminates costly multiple setups and expensive machine operations; can be moved easily to unwieldy workpieces, eliminating the expensive transportation and setting up of jobs on fixed machines. A bulletin giving additional details may be obtained from the KAUKAUNA MACHINE CORP., Dept. 86, Kaukauna, Wis., or use INFORM-A-GRAM Key No. K86-X.

**LIGHT ENOUGH AND SMALL ENOUGH TO BE CARRIED,** although it has a capacity of seven tons with a three inch stroke, the "MOBIL-POWR" unit, which, through the application of extra attachments can be utilized as a puller, lifter, spreader, "C" Clamp, jack or a four-posted press, is foot operated and meets hundreds of needs for manufacturing concerns, welding shops, experimental

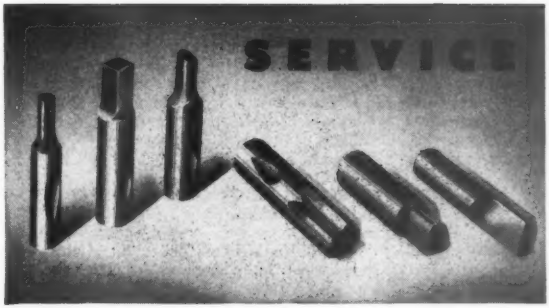


research labs, etc. Available as a separate unit, with extra attachments purchasable when needed, the "MOBIL-POWR" will be further explained upon request by MUNTON MFG. CO., Dept. 10, Franklin Park, Ill., or use INFORM-A-GRAM Key No. J10-X.

**AUTOMATICALLY PERFORMING MULTIPLE OPERATIONS** in drilling, boring, reaming, facing or tapping, a special multiple unit



machine to be used in the production of gas regulator bodies has been designed and manufactured by Baker Bros., Inc. It includes a four-station, automatic power indexing

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**Write: Attention Dept. C**

**Lead Screw ground from solid AFTER hardening.**

**CRITERION MACHINE WORKS**

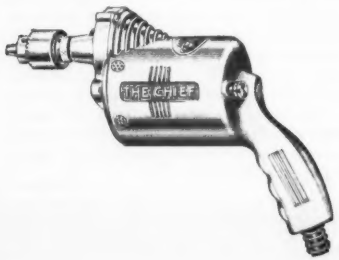
BEVERLY HILLS, CALIFORNIA

table with each station arranged for rechucking one part and chucking a new part. Around this table are built ten independently fed auxiliary units; operations in parts present themselves from five directions, and all holes from the horizontal units have two separate operations. Flexible to accommodate various sizes of regulator housings, this machine features a pivotal multiple head with 18 spindles arranged to handle varying bolt circles. Request additional information from BAKER BROTHERS, INC., Dept. 63, Toledo, Ohio, or use INFORM-A-GRAM Key No. A63-X.

**MAKING STAMPED NUMBERS ON ALUMINUM,** brass and steel parts more easily read, the specially constructed Acroprinter fills in these numbers with black or colored ink or enamel by an easy forward-and-back motion

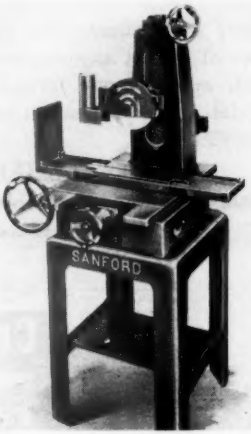
of the hand-operated lever. A synthetic rubber die is used to apply the filling. Equipped with a supply of ink or enamel, Acroprinter 600S can also be used for metal ink printing when an impression of the number is unnecessary. Secure detailed information from THE ACROMARK CO., 5-15 Morrell St., Elizabeth, N. J., or use INFORM-A-GRAM Key No. 636-X.

**WEIGHING ONLY 3¾ LBS.**, the new Portable Electric Drill, "The Chief," recently announced by the Chicago Precision Machine




Company, is constructed to reduce operator fatigue and simplify ease of handling. Drilling up to ¼" in steel and to ½" in wood, this compact and versatile tool is ideal for general duty on a wide range of production and maintenance jobs. More complete information will be supplied by CHICAGO PRECISION MACHINE CO., Dept. 95, 920 S. Michigan Ave., Chicago 5, Ill., or use INFORM-A-GRAM Key No. K95-X.

**THOUGH INCORPORATING MANY OF THE SPECIAL FEATURES** of the Sanford Bench Surface Grinder, the new larger Model MG Surface Grinder offers still other entirely new developments. Comparable with precision




accuracy and finish to the smaller machine, Model MG has a hardened and ground alloy steel grinding spindle mounted in precision ball bearings, is protected against grinding dust, and has friction-resistant Oilite bushings and needle bearings which are lubricated for life—to assure ease of operation, longer life and minimum of wear. Further inquiries will be answered by SANFORD MFG. CO., Dept. 1-28, 1020-28 Commerce Ave., P. O. Box No. 397, Union, N. J., or use INFORM-A-GRAM Key No. 128-X.

**DESIGNED TO CAST 14.88 POUNDS OF ALUMINUM ALLOY PER SHOT** at an injection pressure of 25,000 psi, representing a casting volume of 154½ cu. in., the new All-Hydraulic Die Casting Machine announced by Hydraulic Press Mfg. Co. is able to produce interchangeable, high quality parts at a very high hourly rate, and to shape them so precisely that finishing operations are reduced to a minimum. Of the same basic design as the smaller

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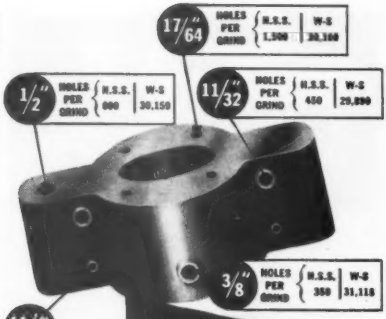
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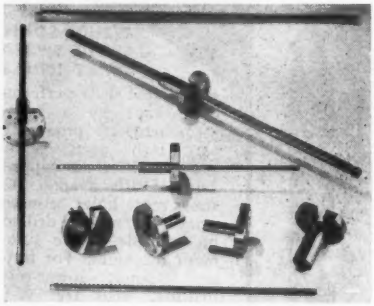
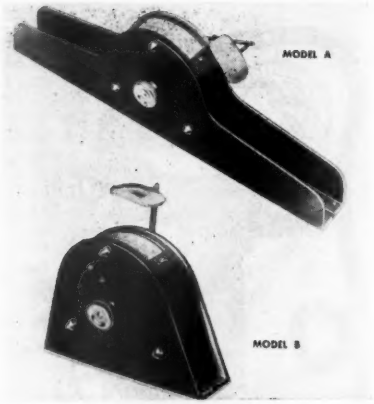
**CORRECTLY DESIGNED, ACCURATELY MACHINED AND PROPERLY HARDENED AND GROUND,** Zagar Keyway Broaches, obtainable from stock in ⅛" to ½" sizes, assure standardized and precise usage. The broaches



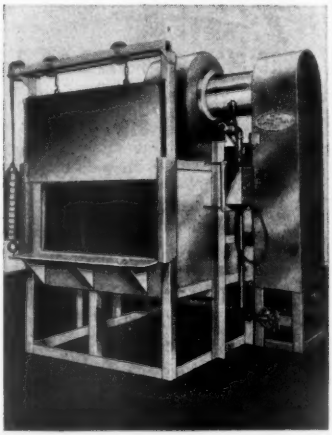
are automatically positioned to cut to proper depth by horn-type adaptors (available in ½" to 1¼" sizes) fitting close into the pocket of the face plate. A change from one setup to another size can be accomplished by quick selection of the proper adaptor which suits the bored hole in the part to be broached. More information is in Bulletin TD-3, available from ZAGAR TOOL CO., INC., Dept. 6-50, 23880 Lakeland Blvd., Cleveland 17, Ohio, or use INFORM-A-GRAM Key No. 650-X.

**NOW MADE WITH AN ALL ALUMINUM HOUSING** for lighter weight, a new special window for easier reading and improved stability and other mechanical features added on the basis of experience, the improved Clinometer Vernier Angle Gage is for use on lathes, drill presses, shapers, gear hobbers and for test setups in the inspection room. Models A and B are for general purpose use; other models are available for specialized fields. A




ball-bearing supported free swinging drum points out degrees of inclination as its center of gravity falls under its center line. Reading accuracy of vernier is one minute of arc. Request other details about this instrument from ENGIS EQUIPMENT CO., Dept. 9-39, 431 S. Dearborn St., Chicago, Ill., or use INFORM-A-GRAM Key No. 939-X.

**HOLDING THE TEMPERATURE FOR HEAT TREATING** of aluminum alloys with little or no variation, the Bellevue batch-type furnace



employs an atmospheric type burner mounted on the lower end of a recirculating heat duct, thus eliminating any necessity of an extra

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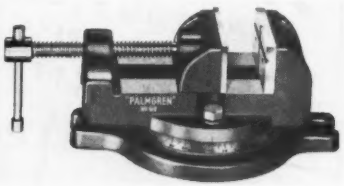
heating unit; a Garden City high temperature fan does this recirculating. Inquiries for additional information may be directed to the BELLEVUE INDUSTRIAL FURNACE CO., Dept. 47, 2917 Bellevue, Detroit, Mich., or use INFORM-A-GRAM Key No. J47-X.

**AFFORDING QUICK, ACCURATE SETUPS** at any radius within 360°, the new rugged Palmgren Milling Machine Vise, developed by Chicago Tool & Engineering Co., is compact and low-built with a swivel base. Designed

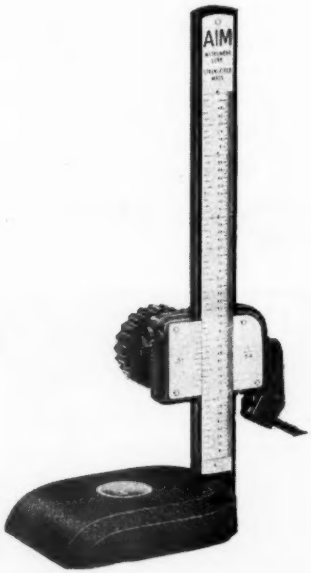


to resist tool pressure and vibration, to save hours of setup time and minimize inaccuracy and rejections, this vise has steel jaws, grooved to hold round pieces. Information about this precise, though economical, tool holder may be requested from CHICAGO TOOL & ENGINEERING CO., 8388 South Chicago Ave., Chicago 17, Ill., or use INFORM-A-GRAM Key No. 591-X.

**HERETOFORE CLASSIFIED SPECIAL TOOLS,** a full line of H.S.S. Tapered Spiral Cutters is now being produced as standard stock by

Cadillac Cutter Co. Cutters included in this line range from ½° to 7° taper per side, ½" to 3½" flutes, and small end diameters from 3/32" to ½". They are particularly suited to machining all types of dies, molds, and patterns where draft or clearance is required, and also may be used on a wide range of general machining operations. Full descriptions are given in a folder available from CADILLAC CUTTER CO., Dept. 99, 1613 Eastern Ave., S.E., Grand Rapids 7, Mich., or use INFORM-A-GRAM Key No. K99-X.

**QUICK-ACTING, NON-GLARING, INEXPENSIVE,** and easily adjusted and locked, the new vernier height gage announced by Aim Products Co. is available in two models reading from zero to six inches; one is graduated




by .01" and in fractions by 1/64ths; the other, by .01" and to 15 cm. by .1 mm. Well constructed with either a cast-iron or aluminum base, this gage may be fitted for holding standard indicators and a depth reading bar. All metal parts are finished in baked enamel and treated to prevent rust. A useful pencil lead holder is also included. Get more data from AIM PRODUCTS CO., Dept. 93, 1564 Main St., Springfield, Mass., or use INFORM-A-GRAM Key No. K93-X.

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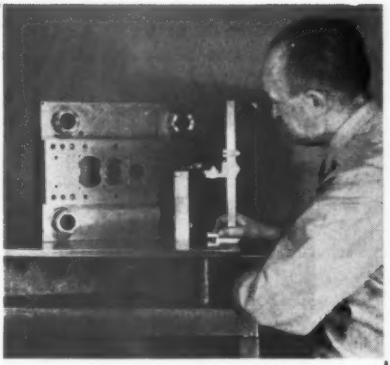

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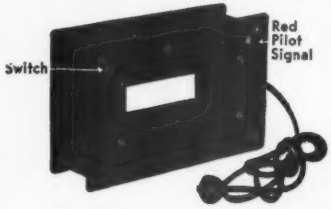


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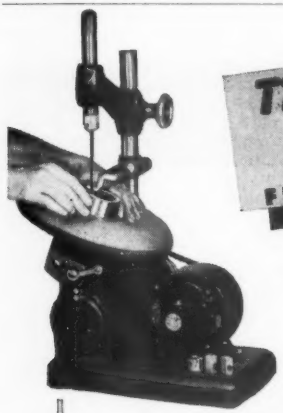

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**EMPHASIZING OUTSTANDING POINTS** about the latest in carbide tools, the new New England Carbide Tool catalog carefully details information on standard carbide tools, form tools, dies, gages, diamond tools, masonry drills and special items, including their fabrication, uses, specifications and prices. Diagrammatic explanations, vivid photographs, and handy indexing are the devices employed to make this 20-page catalog especially useful. Punched for insertion in a standard 3-ring binder, it may be secured from NEW ENGLAND CARBIDE TOOL CO., INC., Dept. 58, 60 Brookline St., Cambridge 39, Mass., or use INFORM-A-GRAM Key No. 58-X.

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**PRESENTING AN OVER-ALL PICTURE OF U. S. BUSINESS BOOMS AND DEPRESSIONS** since 1775, the annual Ex-Cell-O graph, reviewing business at a glance, shows the relative financial trends of federal receipts, debt, taxes, income, cost of living dollar and business activities; as well as breaking down eras to show the influence of government administration, wars and major industrial changes of the period. Vividly colored and self-explanatory, this chart may be requested along with the recent issue of Tool Tips which reviews the Ex-Cell-O Corp. progress during the past years and their plans for the future. Write to the EX-CELL-O CORP., 7-37, 1200 Oakman Blvd., Detroit 6, Mich., or use INFORM-A-GRAM Key No. 737-X.

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**TWENTY-EIGHT BROACHING EXAMPLES** for internal and external machining of simple or complex shapes are described with corresponding illustrations in "Colonial Broaching News," Vol. VIII, No. 4. Included in this new literature are interpretations of several fields of manufacture. Copies may be requested from COLONIAL BROACH CO., Dept. 26, P.O. Box 37, Harper Station, Detroit 13, Mich., or use INFORM-A-GRAM Key No. 26.5-X.

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**HOW HIGH UNIFORM QUALITY IS MAINTAINED** in AristoCraft Power tools is explained in a 32-page catalog released by Aristo Power Tools, Inc. Modern manufacturing facilities are pictured along with a complete

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**CONTROLLING IRREGULAR FORMS** in the course of production on any type of machine tool is the purpose of the Profiloscope, a special optical attachment manufactured by Precision Grinding Co. of England. Its principal application is the control of relieving, turning and grinding operations and also form lapping. Other optical instruments, such as the angle meter for comparing of angles by autocolimation and other analogous uses, are contained in literature available from AMERICAN MEASURING INSTRUMENTS CORP., American representatives, Dept. 1-86, 240 West 40th St., New York 18, N. Y., or use INFORM-A-GRAM Key No. 186-X.

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**FOR DIE SINKERS AND TOOL MAKERS,** T-J cutters are indexed in a 20-page brochure released by the Tomkins-Johnson Co. Importance of good cutting tools, their ability to fulfill necessary requirements and quality of

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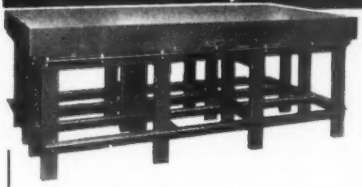

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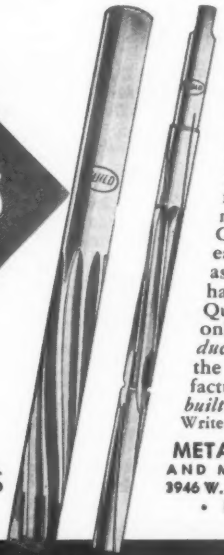

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**A CHANGE IN PRICE STRUCTURE** on Bayflex products was recently announced by Bay State Abrasive Products Co. Consumer discounts are subject to a "product" discount and a "quantity" discount which are explained in literature also containing list prices of grinding wheels, sticks and arbors. Available upon request are two four-page bulletins describing in detail the many practical uses of Bayflex products. Write BAY STATE ABRASIVE PRODUCTS CO., Dept. 2-05, Westboro, Mass., or use INFORM-A-GRAM Key No. 205-X.

**LATEST DEVELOPMENTS IN THE ENGINEERING APPLICATIONS OF MEEHANITE CASTINGS** in industry are contained in Bulletin No. 24, first of a series in a new type of news publication. This informative eight-page bulletin discusses the successful brazing of Meehanite to steel, showing on-the-job scenes, assembly drawings and cutaway views, also its adaptability to numerous industries. Copies of the Bulletin are available from MEEHANITE METAL CORPORATION, Dept. 3-88, Pershing Square Bldg., New Rochelle, N. Y., or use INFORM-A-GRAM Key No. 388-X.

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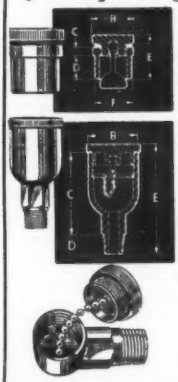

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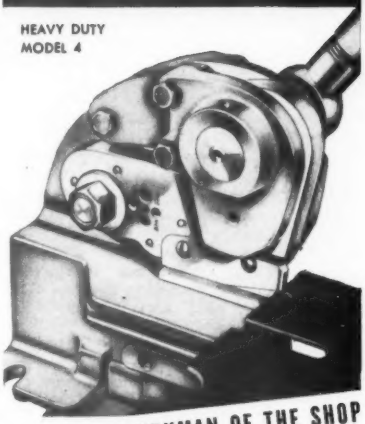

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**EXTREME ACCURACY AND LONG LIFE** are obtained in Springfield 30" medium duty geared head lathe which is fully illustrated in a recent Bulletin No. 165. Detailed photos of the headstock, apron, taper attachment, compound rest, and tailstock, along with descriptive information and specifications, complete the eight-page colored bulletin. Request copies from THE SPRINGFIELD MACHINE TOOL CO., Dept. 6-47, Springfield, Ohio, or use INFORM-A-GRAM Key No. 647-X.

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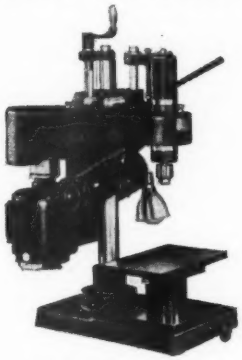
**PRECISION GROUND FLAT STOCK,** designed to expedite production of parts and pieces having two flat parallel surfaces, are now available in two types from L. S. Starrett Co. Oil Hardening Ground Flat Stock is a non-deforming electric furnace tool steel, and Water Hardening, a high grade tool steel. It saves the time of skilled tool and die makers by eliminating all preliminary roughing and precision grinding prior to machining. Write to L. S. STARRETT CO., Dept. 6-99, 121 Crescent St., Athol, Mass., or use INFORM-A-GRAM Key No. 699-X.

**THE HISTORY AND PROGRESS** of the independent tool, die and special machine plant is cited in a booklet entitled "Going National". An over-all look at present expansion and how the independent shop has struggled and grown to serve broader markets is given. An interesting booklet, "Gearing Special Purpose Machinery to the Human Factor", is also offered free by the BUNELL MACHINE & TOOL CO., Dept. 8-86, 1601 East 23rd St., Cleveland 14, Ohio. Write to the company or use INFORM-A-GRAM Key No. 886-X.

**"STANDARD GLASS SCREENS",** a new catalog released by Jones and Lamson Machine Co., contains descriptions of screens for all models of Jones and Lamson Optical Comparators. Two types of screens are available in five different sizes; clear or frosted with outlines on the front surface, and overlay screens of clear or frosted with outlines on the back surface. Write JONES & LAMSON MACHINE CO., Dept. 3-42, 1935 Jolam Blvd., Springfield, Vt., or use INFORM-A-GRAM Key No. 342-X.



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# Hardening
# A Complicated Die

Most of us do not frequently have the problem of hardening a die as complicated as the punch board die shown in Figure 1. Nevertheless, it may be interesting to know of some of the difficulties that may be encountered on such a job, and what efforts were made to eliminate and overcome these difficulties.

The people working in a commercial heat treating plant see various types of tools coming in for hardening. After heat treating various punch board dies, when we received this one which measured approximately 22" long by 16" wide by 1½" thick with 2,850 holes in it, no one became too concerned. This die was made of the normal oil hardening tool steel with the following analysis:

.95 Carbon
.50 Chrome
1.05 Manganese
.25 Vanadium
.50 Tungsten

Our first precaution on a punch board die of this type (when the holes have already received the "finish" drilling operation) is to stress relieve.

**by Andrew L. Olson**
*from "Heat Treating Hints"*
***Lindberg Engineering Company***
***Chicago, Ill.***

We might point out here that in many cases it is considered better practice to only *rough drill* the holes *prior* to stress relieving. Then any distortion in the roundness of the holes that might occur during stress relieving, could be corrected in the "finish" drilling operation, which can be done *after* stress relieving.

However, as mentioned above, this die was received in the finished condition. Stress relieving of the die was at 1200° F. for three hours, followed by transfer to a high heat Hydryzer at 1475° F. where it was held for 90 minutes, then quenching into a nitre salt bath at 400° F. and holding for fifteen minutes.

Upon cooling from the nitre salt bath, we straightened the die to approximately .010" for flat. After the die had reached room temperature, it was drawn at 400° F. for four hours, allowed to cool to room temperature, and re-drawn at 400° F. for another six hours.

When the die reached our inspection department for final checking for hardness and straightness, it was noted by our inspector that it was perfectly flat, but that it had gone out of straight from .024" to .025" edgeways. Immediately everyone became excited with the thought that this die was no longer usable due to warpage, and that a damage bill would have to be accepted by us.

It certainly is very disheartening to note, after taking every possible precaution, that unexplainable difficulties such as this will sometimes arise. However, this is not the time to give up. The good heat treater at this point must use his entire technical skill to rectify these unforeseen difficulties.

Consequently, after much discussion on what to do with the die it was decided to give it a good anneal, which was as follows: it was packed in a protective medium and heated to 1400° F. until thoroughly heated through, then furnace cooled. Our thought was that this anneal would bring the die back to shape, but much to our sorrow it didn't move a bit

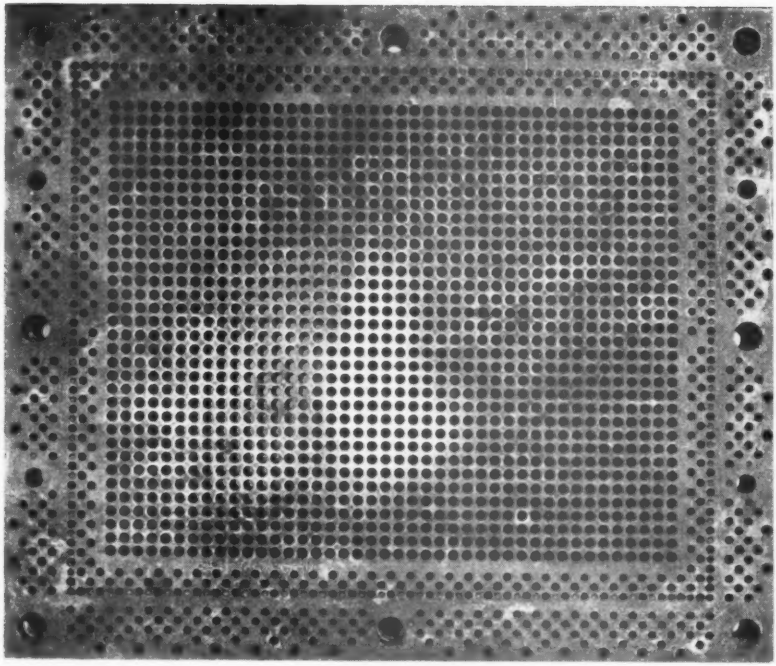


*Fig. 1. Punch board die, 22" x 16" x 1½", containing 2850 holes. The die was made of an oil hardening tool steel. The slightly smaller holes in the marginal areas of the die are to insure uniform heating and quenching. Without these holes, the margin would, in effect, constitute a heavy section adjacent to a light section. The heating and quenching speeds of such a heavy section would be slower than for the main part of the die, hence distortion or breakage might occur.*

and remained .025" out of straight edgeways.

Our next move was to straighten it, if this were possible. To put pressure on the high side would definitely make the holes in the center out of round, as shown in Figure 2, so our thought was to heat the die to 1400° F. and place the die with the high side down on a face plate, Figure 3, and press at two points of pressure where the die was of heavier body. At first glance, many people wonder why applying pressure with the high side of the die up as shown in Figure 2 would cause the holes to go out of round, whereas they would not with the high side down as shown in Figure 3. You will note that to accomplish straightening with the high side up, it is necessary for the corners resting on the face plate and designated as X and Y in Figure 2 to move outward. It can be readily seen that as long as pressure is exerted in a downward direction, these corners will tend to dig into the face plate, and not move in the outward direction necessary.

However, with the high side of the die down as shown in Figure 3, the lower two corners nearest the face plate need only move downward. Outward movement is not necessary and any tendency that the die corners might have to dig into the face plate is eliminated.

After letting the die cool in the press, it was checked for straight and found to be straight within .002".

We then gave it another slow cool anneal from 1400° F. It was checked again for straight, with no apparent movement. The die was then ready for rehardening which was the same as the first except that we were ready for any distortion edgeways. After the quench into a nitre salt bath at 400° F. for 15 minutes, it was transferred to the press and pressed as described above until it reached approximate room temperature.

We again checked it for straight and found that it was straight within .002" edgeways. It was then tempered at 400° F. for four hours, with a redraw at 400° F. for four hours. After tempering, the die was within .002" edgeways and .005" for flat.

There were only four holes that were out of round, and they could be fixed by grinding. The holes that had gone out of round were at the four corners and this was due to the pressure from straightening. It was fortunate that we didn't apply pressure in the normal manner which would have caused the holes in the middle to go out of round.

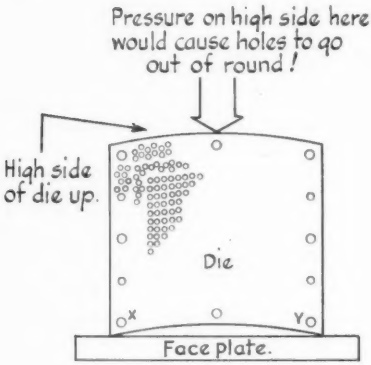
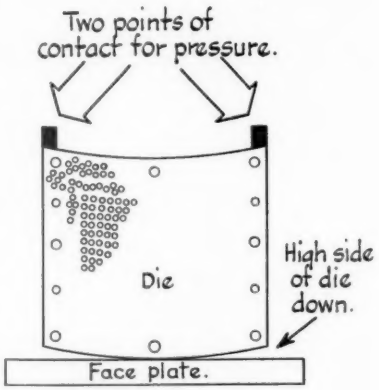



*Fig. 2. If the die straightening pressure had been applied to the high side as shown here, it would cause the holes to go out of round because the lower corners, X and Y, would dig into the face plate and not be free to move in the outward direction necessary for successful straightening.*

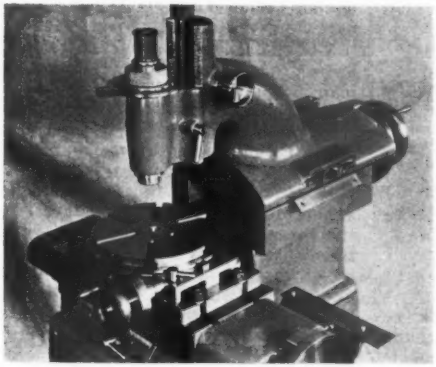
*Fig. 3. With this setup, which resulted in successful straightening of the die, the pressure was applied at two points, and with the "high" side of the die down. Consequently, the two corners nearest the face plate are unrestrained and are free to move in conformation to the upper corners as the straightening pressure is applied.*




Now that we have finished our discussion on the treatment for this oil hardening die, we might mention that with latest heat treating equipment, such as custom heat treaters will have, it probably would have been better if the die had been made of an air hardening steel; perhaps a 5% chrome, 1% moly, 1% carbon. A die of air hardening steel would have more wear resistance and be less subject to change or distortion.

Original cost of this type of air hardening steel is but little more than oil hardening. Labor on an air hardening piece such as this punch board die (where most of the work is drilling) would not be a great deal more than if the part were made of oil hardening steel.

However in smaller shops that might not have all new and modern equipment that will permit controlled atmosphere treatment at high temperature, it will be safer in the long run to use oil hardening steel and quench in nitre salt as explained in the body of this article.



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## Shop Talk On Quality Control

*(CONTINUED FROM PAGE 78)*

N = 52 (fifty-two cards in the deck)
R = 5 (five-card combination)
* = The last term or number in the multiplication sequence (in this case, the fifth)
R! = R taken factorially (5×4×3×2×1)
It then becomes:

$$C = \frac{52(52-1)(52-2)(52-3)(52-5+1)}{5\times4\times3\times2\times1}$$

$$= \frac{311{,}875{,}200}{120} = 2{,}598{,}960$$

If the reader doesn't believe this, he can either multiply it out by longhand or take a long vacation and start counting matches every time he assembles a different five-card hand.

If the problem had been to find out how many different six-card hands there were in the deck, the answer would have six terms in the multiplication sequence, or:

$$C = \frac{52\times51\times50\times49\times48\times47}{6\times5\times4\times3\times2\times1}$$

$$= \frac{14{,}658{,}134{,}400}{720} = 20{,}358{,}520$$

The astronomical figures involved are simplified by another example which can be figured out with three different colored marbles if the reader is still somewhat skeptical.

How many different color combinations of two marbles each can be arranged with one each of a red, white and blue marble?

$$C = \frac{3\times2}{2\times1} = \frac{6}{2} \text{ or } 3$$

or

(1) Red & White
(2) Blue & White
(3) Red & Blue

The reader no doubt wonders what all this has to do with Quality Control. It is simply that the foregoing examples are presented in order that the shop man will accept the mathematical constants used in Quality Control computation as practical and authentic, and realize that they are tools of the trade just as surely as the micrometer and the height gage are natural to the machinist's trade, having been devised by experts in their particular fields.

To get back to Quality Control in the average shop, let's define the term as a map or guide to good work on the machine which assists the operator in setting tools, adjusting cams and cross-slides and in keeping his machine in good repair. All shop men are familiar with plus and minus tolerances on blueprint dimensions. Also, they are familiar with the various types of gages used to assist them in checking their work. However, those who are not familiar with Quality Control need this additional tool to keep the machine turning out good work and to warn them when tools are getting dull or tool slides are getting too loose to produce close tolerance work.

Old time inspectors (some of them, that is) will state that there is no substitute for 100% final inspection. The writer will not attempt to argue the point in this article. However, he will make the statement that when scrap is found at the 100% final inspection bench, the deed is done, the horse is stolen and scrap is wasted manpower, machine time and money. Wouldn't it have been far better production practice to have prevented the formation of scrap in the first place, if such could have been accomplished?

Some floor inspectors will also state that early attempts at, say, 10% inspection at the machines, as tried years ago, did not prove too practical because scrap still appeared at the final inspection bench. The writer agrees with them. However in those days the percentage figures were arbitrarily chosen by rule of thumb and the operator's map or warning chart was not a part of the program. Quality Control is not merely percentage floor inspection sampling. It goes much deeper into the problem of dimensional control.

The map or warning chart previously mentioned can be aptly compared to a modern concrete highway. This reference or comparison is used in many textbooks on the subject and is not original with the writer. Figure 1 shows a modern highway complete with center line, pavement, shoulders and ditches. Figure 2 shows a simplified Quality Control

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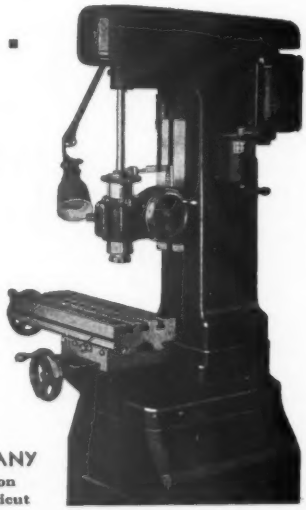

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chart, i.e., the map or guide which the operator requires in order to consistently turn out good close tolerance work.

The center line of the pavement can represent the mean tolerance or average, the edges of the pavement can represent the upper and lower control limits, the plus or minus tolerances can represent the edges of the ditch; beyond this scrap or disaster results either on the road or in a machine operation.

Sometimes colored control charts are used to demonstrate the highway analogy. The pavement, or the area between the upper and lower control limits, uses a light green color. The green of the "go" light so familiar to all drivers depicts the safe operating zone. The areas between the upper and lower control limits and the upper and lower tolerances are of an amber color and represent a caution zone or "change" light. The areas outside the upper and lower tolerance lines are in red and represent a danger zone or "stop" light. The machine is out of control when the red area is encountered whether it be turret-lathe or the family jalopy. The operator or driver must take immediate steps to correct the course or stop the machine because scrap results in either instance.

The control chart is merely the shop application of what the Quality Control engineer terms a Frequency Distribution Curve. To familiarize the reader with some necessary terminology used in simple Quality Control application, the frequency curve is shown in Figure 3.

Fifty pieces, requiring a plunge cut, are run on a centerless grinder. One dimension, the OD, is considered critical and the fifty pieces varied in size as plotted in Figure 3. By connecting the peaks with a continuous line we have a curve; a curve called the Frequency Distribution Curve.

Statistical mathematics divides the area within the curve into six equal zones or increments. Each of these zones or increments is one SIGMA wide and is denoted by the Greek alphabet letter $\sigma$ or $\Sigma$. In other words, there are three SIGMA-wide strips or zones on either side of the average line. The actual determination of the SIGMA width is determined by statistical mathematics and is known to the worker in statistical mathematics as the STANDARD DEVIATION. The writer will not attempt to explain the derivation of the standard deviation; the reader will be pleased to know that the whole process resolves itself into a few simple constants which will be explained more fully in a later paragraph. The upper and lower (3-Sigma) lines shown in Figure 3 are designated as the upper and lower control limits. These control limits will be clearly explained in a later paragraph.

Don't become alarmed at the use of the Greek alphabet. The zone width called SIGMA could just as easily have been termed, "Kilroy," "Jive," or "Hep". It's just a term used by statistical mathematicians and Quality Control engineers. It's the jargon of the trade just as "mikes" and "jo-blocks" are the mainstays of the inspector's daily griping to the production foreman. But, remember the term SIGMA and 3-SIGMA as the upper and lower control limits. Also, learn to recognize the symbols $\sigma$ or $\Sigma$ when the boys from the front office condescendingly try to pass over the reference.

The 3-Sigma, upper and lower control limits are the two edges of the concrete pavement illustration. Operating between them means safety. Operating beyond them means your front wheels are on the soft shoulder and if you don't watch yourself you'll be heading for the ditch and will be heading for the scrap heap.

All Frequency Distribution Curves, however, are not so symmetrical as the illustration. Figure 4 shows a curve where the machine operator is holding his work to the high limit.

The use of the frequency curve is limited to office calculation, whereas Quality Control application in the shop uses a CONTROL CHART. This is the guide or map used by the operator to keep his machine operating in a well defined manner and to keep him from producing scrap. This chart is mounted on a clip board or similar holding device at the machine where the operator can easily see it and the Quality Control inspector can record on it.

*(TO BE CONTINUED IN JUNE)*

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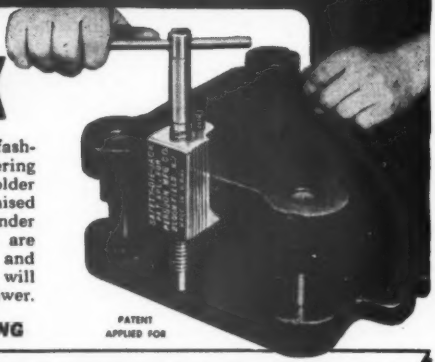

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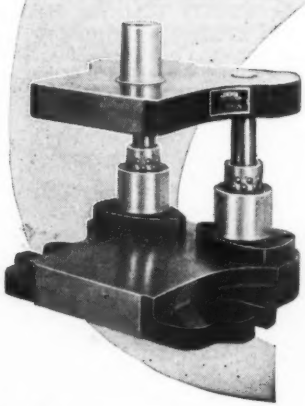

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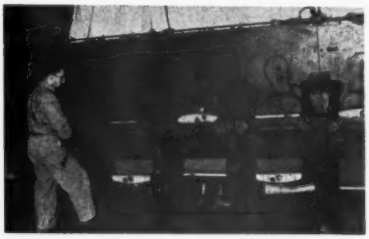

solder ring containing the exact amount of solder necessary for a perfect joint, International Harvester Co. boasts uniform joints without costly waste. For this improved quality there has been totalled an annual savings in solder costs alone of $7,000.00.

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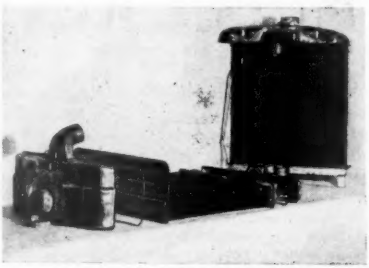
The exploded view of the radiator assembly, Figure 3, shows the component parts. The completed radiator is shown at the extreme right of the photograph.

Figure 1 shows a six-station unit set up for three types of Harvester radiators. One station is used to solder the top tank assembly and the adjacent station handles the bottom tank assembly of the same radiator. The operator places a preformed solder ring on the top tank unit, fluxes the joint, inserts

the radiator in the fixtures and pulls down the hinged inductor coil (Figure 2) which is of the split type. Then he pushes the control button and the heating cycle is automatically timed. At the completion of the heating cycle (30 seconds) the radiator is removed, inverted, placed in the adjacent station and the procedure is repeated on the bottom tank assembly.

Other interesting facts and figures about the TOCCO Induction Heating unit may be obtained by writing to The Ohio Crankshaft Co., Dept. TD, 3800 Harvard Avenue, Cleveland 1, Ohio, or use INFORM-A-GRAM Key No. 415-X.



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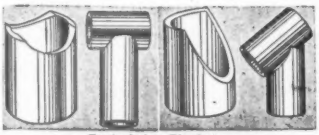

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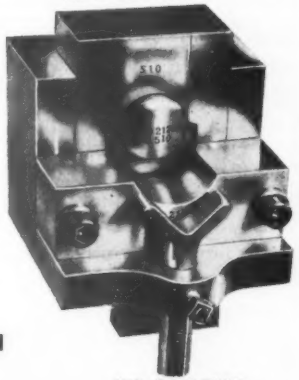

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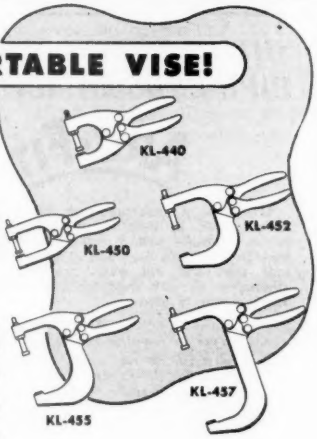


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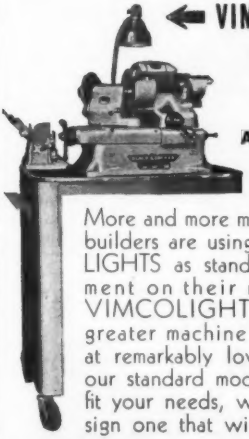

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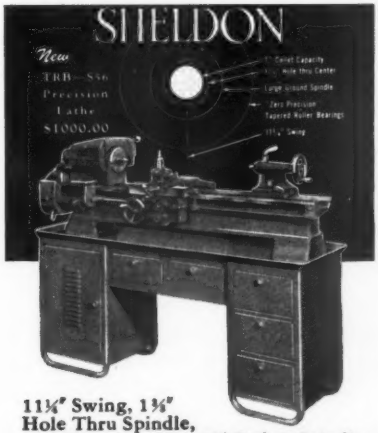


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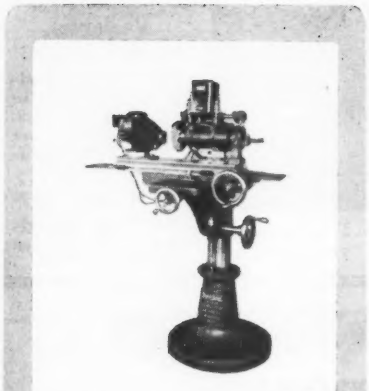


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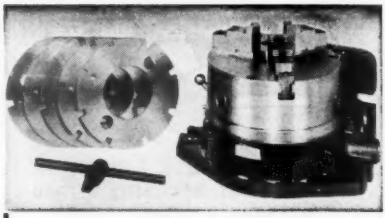

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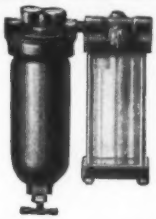

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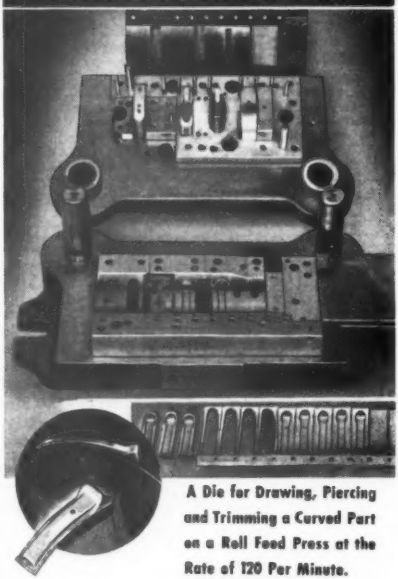

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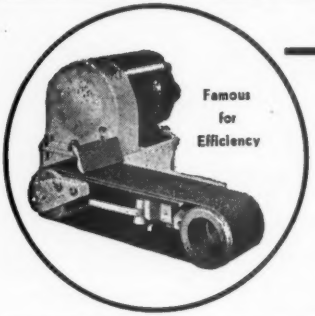


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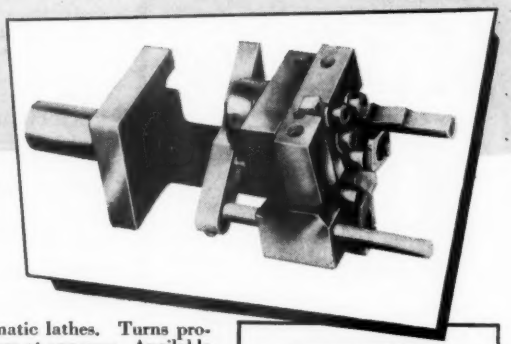

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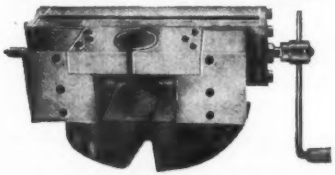

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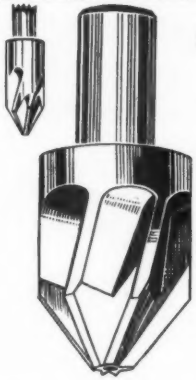

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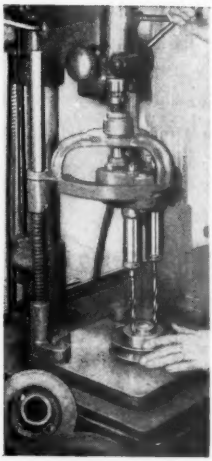

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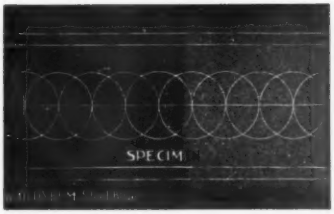


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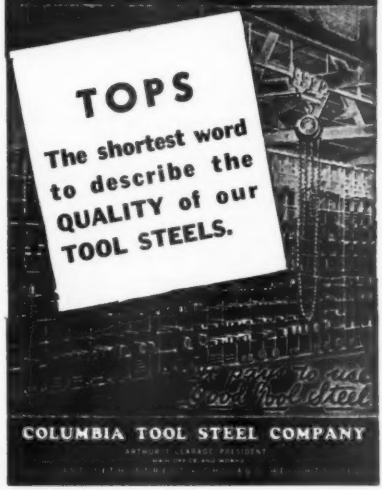


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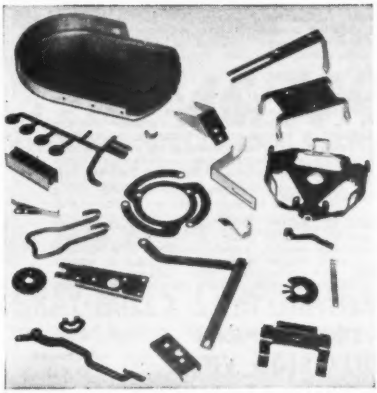

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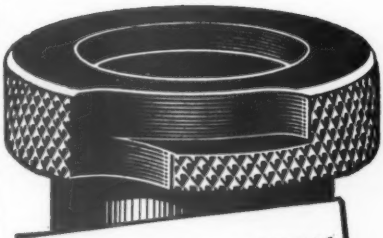

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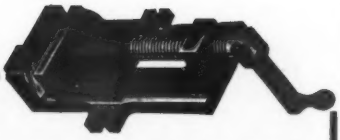

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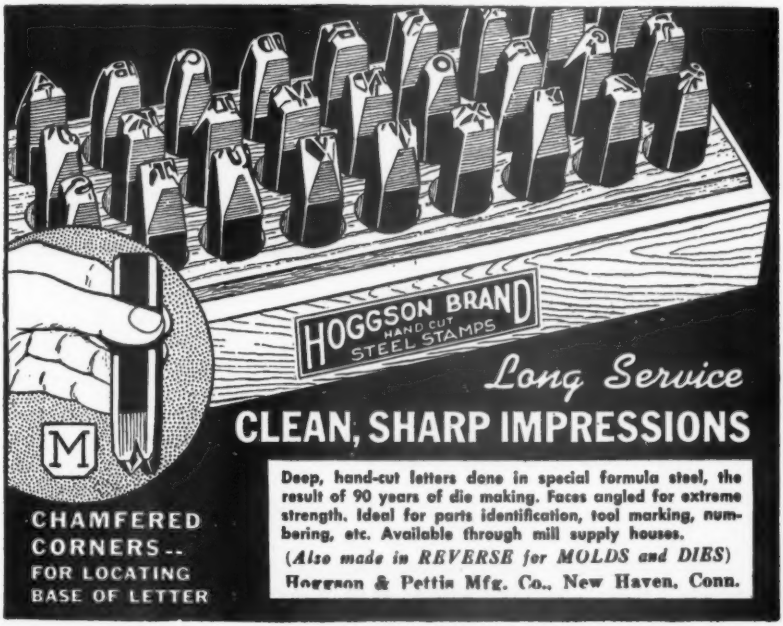


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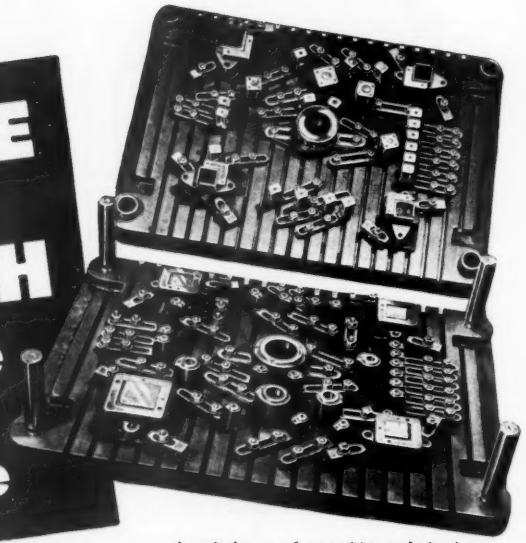

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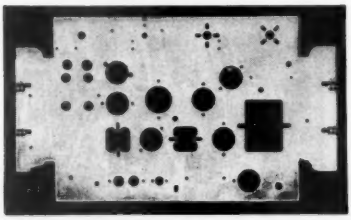

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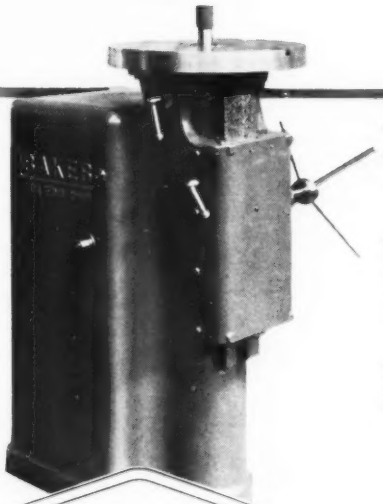

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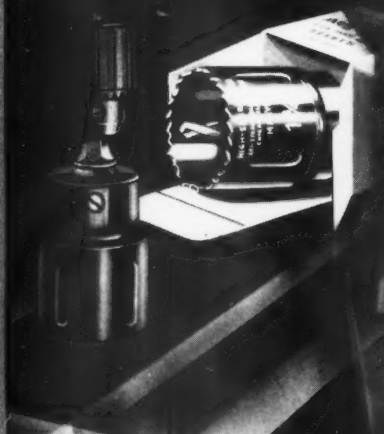

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